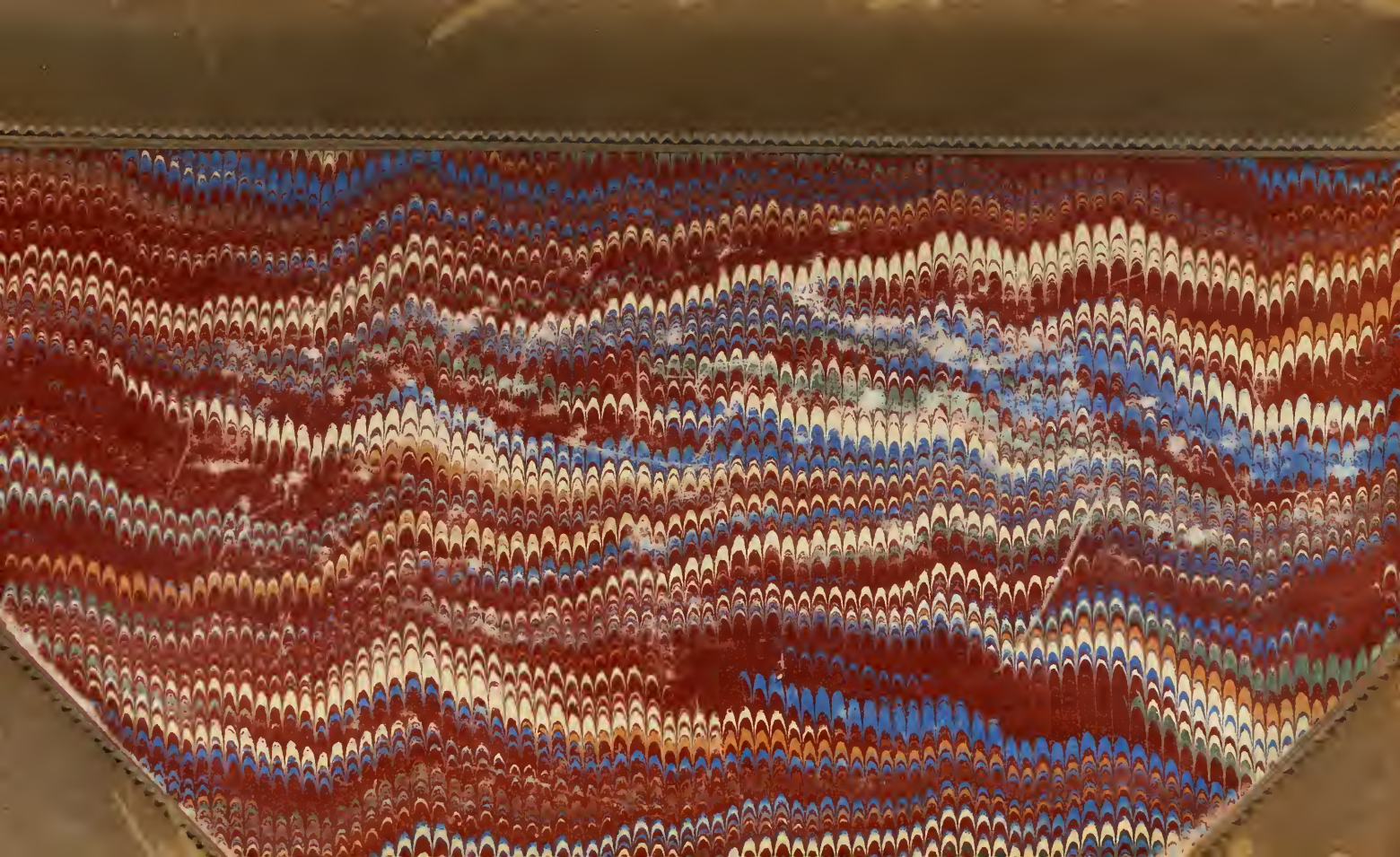
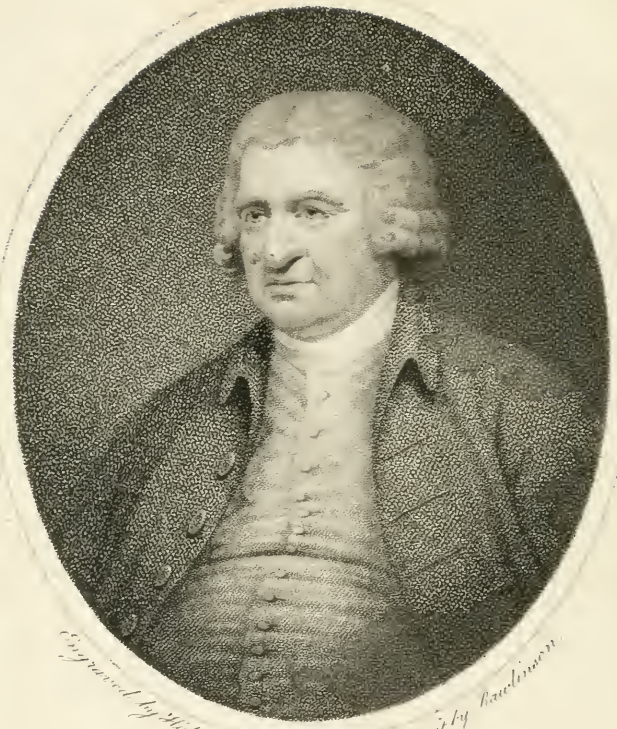


Physical &
Applied Sci.
Serials



Engraved by Hall from the original Portrait by Rawlinson
in the possession of Dr. Thornton.

ERASMUS DARWIN, M.D.

Published October 31st 1803 by J. Phillips George Yard Lombard Street

THE

PHILOSOPHICAL MAGAZINE:

COMPREHENDING

THE VARIOUS BRANCHES OF SCIENCE,

THE LIBERAL AND FINE ARTS,

AGRICULTURE, MANUFACTURES,

AND

COMMERCE.

BY ALEXANDER TILLOCH,

HONORARY MEMBER OF THE ROYAL IRISH ACADEMY, &c. &c. &c.

" Nec aranearum sane textus ideo melior quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes." JUST. LIPS. *Monit. Polit.* lib. i. cap. 1.

VOL. XXIX.

For OCTOBER, NOVEMBER, and DECEMBER, 1807;
and JANUARY, 1808.

LONDON:

PRINTED FOR JOHN MURRAY, FLEET STREET; AND
A. CONSTABLE AND CO. EDINBURGH:

And sold by RICHARDSON; CADELL and DAVIES; LONGMAN, HURST, REES, and ORME; SYMONDS; VERNOR, HOOD, and SHARPE; HARDING; HIGHLEY; London: BELL and BRADFUTE, Edinburgh: BRASH & REID, and D. NIVEN, Glasgow; and GILBERT and HODGES, Dublin.

QC
1
P4
v.29

143903
11/11/91
b.

CONTENTS

OF THE

TWENTY-NINTH VOLUME.

I. *A STATISTICAL Account of Upper Canada. By* J. B. GALT, *Esq.* 3

II. *Summary Considerations upon variegated Colours of Bodies when reduced into thin Pellicles; to which is added an Explanation of the Colours of tempered Steel, and of those of Peacocks' Feathers. Extracted from a Work on Colours; by* C. A. PRIEUR 11

III. *Upon the most sensible Re-agents with respect to the Muriatic, the Carbonic, the Sulphuric Acids, and Ammonia. By M.* PFAFF, *Professor of Chemistry at Kiel* .. 17

IV. *Some further Remarks upon the supposed Formation of Muriatic Acid in Water by the Influence of the Galvanic Pile. By Professor* PFAFF 19

V. *Essay upon the Art of the Foundry among the Antients: with some Remarks upon the celebrated Horses of Chio, now brought from Venice to Paris. By M.* SEITZ .. 20

VI. *Facts for a History of the Gallic Acid. By M.* BOUILLON-LAGRANGE 29

VII. *Note upon a fulminating Combination of Silver, of a white Colour and a crystalline Appearance. By* M. DESCOSTILS 36

VIII. *Memoirs of* ERASMUS DARWIN, *M. D.* 38

IX. *Description of a circular Mother-of-Pearl Micrometer. By* DAVID BREWSTER, *A. M.* 48

X. *Additional Memoir upon living and fossil Elephants. By M.* CUVIER 52

XI. *On the Phænomena of the Horizontal Moon. By* EZ. WALKER, *Esq.* 65

XII. *Report of the Senior Chaplain of Fort St. George to the Right Honourable Lord* WILLIAM BENTINCK, *Governor of Madras, on the State of the Christians inhabiting the Kingdoms of Cochin and Travancore* 68

XIII. *Report of Surgical Cases in the Finsbury Dispensary from the Beginning of February to the End of April* 1807; *with the Appearances, on Dissection, in a Case of Aneurism; and some Observations on that Disease, by* JOHN TAUNTON, *Esq.* 83

XIV. *Proceedings of Learned Societies* 85

XV. *Intelligence and Miscellaneous Articles* 90

XVI. *Proposal for a new System of Building Houses, Streets, &c. By* G. FIELD, *Esq.* 97

XVII. *On the Œconomy of Bees. In a Letter from* THOMAS ANDREW KNIGHT, *Esq. F. R. S. to the Right Honourable Sir* JOSEPH BANKS, *Bart., K.B. P.R.S.* 104

XVIII. *Note upon a fulminating Combination of Silver, of a white Colour and a crystalline Appearance. By M.* DESCOSTILS 112

XIX. *Observations and Measurements of the Planet Vesta. By* JOHN JEROME SCHROETER, *F. R. S. Translated from the German* 115

XX. *A new Eudiometer, accompanied with Experiments elucidating its Application. By* WILLIAM HASLEDINE PEPYS, *Esq.* 116

XXI. *On Public Libraries* 126

XXII. *Memoirs of the late* ERASMUS DARWIN, *M. D.* 129

XXIII. *Some Account of a Journey to the Frozen Sea, and of the Discovery of the Remains of a Mammoth. By M.* MICHAEL ADAMS, *of St. Petersburgh. Translated from the French* 141

XXIV. *Essay upon the Art of the Foundry among the Antients: with some Remarks upon the celebrated Horses of Chio, now brought from Venice to Paris. By M.* SEITZ 154

XXV. *On the Making of Starch. By Mr.* JAMES GRAHAM, *of Berwick-upon-Tweed* 166

XXVI. *Report of Surgical Cases in the Finsbury Dispensary from the Beginning of May to the End of June* 1807, *with the Appearances on Dissection in a Case of Hydrocephalus. By* JOHN TAUNTON, *Esq.* 169

XXVII. *Notices respecting New Books* 171

XXVIII. *Proceedings of Learned Societies* 180

XXIX. *Intelligence and Miscellaneous Articles* .. 188

XXX. *Proposal for the Establishment of a National Museum. By* J. S. DUNCAN, *Esq. of Lincoln's Inn* .. 193

XXXI. *Pro-*

XXXI. *Project for the Establishment of Telegraphs on a New Construction. By Captain* PASLEY, *of the Royal Engineers* 205

XXXII. *Some Observations on Dr.* TAYLOR'S *Theorem for the Development of the Function* $\varphi(a + x)$ .. 211

XXXIII. *On the Quantity of Carbon in Carbonic Acid and on the Nature of the Diamond. By* WILLIAM ALLEN, *Esq. F.L.S. and* WILLIAM HASLEDINE PEPYS, *Esq.* 216

XXXIV. *Account of the Discoveries made by the Rev. Dr.* BUCHANAN, *in the course of his Investigations undertaken by Order of the Supreme Government of Bengal* .. 228

XXXV. *On the probable Composition of Sulphur* .. 240

XXXVI. *Description of an Improved Galvanic Trough. By* C. WILKINSON, *Esq.* 243

XXXVII. *Additional Memoir upon living and fossil Elephants. By M.* CUVIER 244

XXXVIII. *Memoirs of the late* ERASMUS DARWIN, *M. D.* 255

XXXIX. *Life of the Duke de* CHAULNES 262

XL. *Report of Surgical Cases in the City and Finsbury Dispensaries in July* 1807, *containing a remarkable Case of Cancer in the Breast. By* JOHN TAUNTON, *Esq.* 267

XLI. *Notices respecting New Books* 270

XLII. *Proceedings of Learned Societies* 273

XLIII. *Intelligence and Miscellaneous Articles* .. 285

XLIV. *Directions for constructing a cheap Bed and elastic Frame, for the easy Conveyance of sick or wounded Persons. Invented, and most humbly presented to His Royal Highness the Commander in Chief, by* PATRICK CRICHTON, *Lieutenant-colonel of the Second Regiment Royal Edinburgh Volunteers* 289

XLV. *Project for the Establishment of Telegraphs on a New Construction. By Captain* PASLEY, *of the Royal Engineers* .. .. — 292

XLVI. *Proposal for the Establishment of a National Museum. By* J. S. DUNCAN, *Esq. of Lincoln's Inn* 296

XLVII. *On the Quantity of Carbon in Carbonic Acid, and on the Nature of the Diamond. By* WILLIAM ALLEN, *Esq. F.L.S. and* WILLIAM HASLEDINE PEPYS, *Esq.* 315

XLVIII. *Memoirs of the late* ERASMUS DARWIN, *M. D.* 325

XLIX. *On*

XLIX. *On that Power of the Eye, by which it is adjusted to see Objects distinctly at different Distances. By* Ez. WALKER, *Esq.* 340
L. *On the Stanhope and other Temperaments of the Musical Scale. By Mr.* JOHN FAREY 345
LI. *Report of Surgical Cases in the City and Finsbury Dispensaries for August* 1807. *By* JOHN TAUNTON, *Esq.* 349
LII. *On the Means of gaining Power in Mechanics* 351
LIII. *On destroying Insects injurious to Cultivation* 353
LIV. *Notices respecting New Books* 354
LV. *Proceedings of Learned Societies* 370
LVI. *Intelligence and Miscellaneous Articles* 372

THE

THE

PHILOSOPHICAL MAGAZINE.

I. *A Statistical Account of Upper Canada. By* J. B. Galt, *Esq.**

Of a country so little known as America, it is almost impossible to receive a description of any part without being sensible of an increase of knowledge. Our small stock of facts relative to its aboriginal inhabitants, and the frame of its permanent features, is still insufficient for correct theoretical purposes. We are still unable to conceive how it could have happened that a continent so extensive, equal in the variety of its productions and climates to the old world, should have been found, in the sixteenth century of the Christian æra, more savage and illiterate than those kingdoms of Asia and Africa which many ages before had relapsed into barbarism: and still less are we qualified to form a just hypothesis of those convulsions and events of nature which have given to the American scenery its peculiar magnificence. The French traveller Volney endeavours to prove that the southern interior of North America has only recently become dry, and that in time the lakes of Canada must also be exhausted, and lay open the bosom of the country †. But as the object of this paper is chiefly to give an arranged view of a few statistical recollections which were lately obtained from Mr. Gilkison, of Amherstburgh, in Upper Canada, it is perhaps superfluous to introduce reflections which more properly belong to the general questions of natural philosophy.

Climate.—The climate of Upper Canada is more steady

* Communicated by Mr. Galt.

† Volney's Travels in America.

than that of England. After winter has set in, which happens about Christmas, an intense frost usually prevails three months, during which the rigour of the season is unremitted. Towards the end of March the cold has relented, but vegetation does not effectually commence till the end of April; it proceeds then, however, with great power. Pease, in the course of six weeks after planting, are generally fit for table. Mr. Gilkison describes the summer as hotter than he ever felt it either in the south of England or the north of France; and during the dog days more oppressive than the heat of Jamaica.

Winds.—From the beginning of June to the end of August the wind on the lakes continues westerly during the day, and in the evening it becomes southerly. From what cause this resemblance to the alternate sea and land breezes of the West Indies originates Mr. Gilkison has not attempted to ascertain; but he has observed that on the lakes Huron and Superior, which are less oblong than Erie and Ontarion, the wind is more variable, and when westerly is accompanied with thick fogs. As the season advances, the regular day and night breezes of the lakes subside, and when the cold weather begins the course of the wind becomes as precarious as in other high latitudes.

Diseases.—The province of Upper Canada is not subject to any particular disease. Although the western district has in part been settled more than a century, the small-pox has never reached it. Vaccination has lately been introduced, and all ages have received it. Since the establishment of distilleries the people have become much addicted to drinking, which they pretend to say has reduced the frequency of the ague, with which they were formerly often afflicted. The clearing of the country, however, will probably more rationally account for the change.

Curiosities.—Petrifactions are very common; indeed the whole flat rock in the neighbourhood of Fort Erie appears to be one petrified mass, for at every step something is seen which at one time has been either animal or vegetable substance. Mr. Gilkison saw in a gentleman's possession, some years ago, a petrified hand entire, except the second

second joint of the fore finger, which seemed to have been accidentally broken off. The traders on the river St. Peter's, Mississippi, report that some of them have seen in the possession of the Indians a petrified child, which they have often wished to purchase; but the savages regard it as a deity, and no inducement could bribe them to part with it. Besides the natural curiosities there are others of a description more calculated to excite interest and reflection. These are the ruins of antient fortresses, which appear to have been the work of a race different from the present Indians, who possess no tradition concerning their origin, nor seem to entertain any opinion respecting their use, or of those by whom they were constructed. They are regularly formed, and generally built where a ravine or high bank naturally strengthens the one side. The walls are of earth, and at present may be about four or five feet in height. At one time they must have been much higher, for trees of the very largest size are now growing on the mounds. A continued barrier of these works extends from the northern side of Lake Ontario towards the river district, and across to the vast plains which reach to the Mississippi. It may also be mentioned in this place as rather a curious fact, that although Lower Canada is greatly infested with rats, none have ever been seen above the falls of Niagara.

Lakes.—The great lakes have been long gradually decreasing; and in the course of nine years, the period of Mr. Gilkison's residence at Amherstburgh, the waters have fallen nearly two feet perpendicularly. As the discharge at Niagara must in consequence be reduced, the allegations of those travellers respecting the time requisite for wearing the passage of the river there, cannot be correctly founded. It is highly probable that the discharge of the cataract was formerly much greater than it is at present, and the force of the water in mouldering the rock of course more effectual. The long period which in the opinion of those travellers the waters must have taken to form the chasm at the falls, is therefore at least doubtful. The issue from Lake Superior and the upper lakes into Ontario, independent of local streams and springs, is much greater than the discharge at

and naturalists have heard with surprise that the plant cassia, which grows only on the banks of Lake Ontario, is frequently found floating along the coasts of Norway *.

Hemp.—The cultivation of hemp in the Canadas has lately become a popular concern; and government, as well as public societies, have endeavoured to promote it, both as a resource to the navy and as an object of beneficial industry. In Upper Canada the sowing begins on the 10th of June, and in a favourable season ten hundred weight is generally produced per acre. About the middle of September it is pulled, the stalks are tied up in bundles, and steeped a few days in the river; they are then dried and stacked, till the farmers have leisure to break. It has been observed that steeping hemp in stagnated water is better than in running, besides being exposed to less hazard; the farmers, in consequence, intend to form steeping-pits in their hemp-grounds. At one time they used to rot the stalks upon the snow during winter; but it was soon ascertained to be destructive of the fibre, and has been universally renounced. The common hand-break is used in breaking the stalks, which are afterwards scotched with a kind of wooden sword. The hemp is held in the left hand over a perpendicular board, and the sword is used by the right; when this process is finished the hemp is bundled for market. It is unnecessary to remark how laborious this method of cleaning is! About the value of a dollar is allowed for every sixty pounds, or per day, to the labourer; a charge that will prevent the Canadian hemp from ever rivalling the Russian, for in Russia the price of labour is comparatively nothing. The establishment of machinery in aid of manual labour is probably, therefore, the only effectual mode of accomplishing the wishes of government, and of those patriotic associations who have patronized the cultivation of hemp in the Canadas. Government has offered fifty pounds sterling per ton for clean marketable hemp, delivered to agents in the county towns; but this plan, as well as the offer of bounties formerly adopted, has been almost entirely abortive, chiefly

* Darwin's Botanic Garden. Notes to the Loves of the Plants.

owing

owing to the price and hard labour of breaking. Indeed, the culture of hemp would have been probably disused entirely, but for a ropework established at Amherstburgh by Mr. Gilkison in conjunction with a Mr. Mills, where the farmers, on allowing a certain deduction of price for the additional labour requisite to fit their hemp for use, have lately found a steady and regular market. To obviate the laborious process of the hand-break and scotching, Mr. Gilkison has procured the model of a flax-mill, from which he intends to erect, on a large scale, a mill for breaking and cleaning hemp at Amherstburgh. The price of cordage at the ropework, which can only yet be regarded as an experiment, is still high, about five guineas per cwt.; but this is as much owing to the price of tar as to the hemp or labour, for tar from the United States costs about three pounds sterling per barrel. In time, however, if the experiment succeed, tar will be made from the pines of the country, and the necessity of importation obviated.

Miscellaneous Considerations.--There are no historical facts more valuable than those which relate to the formation of communities, and the origin of nations; nor, perhaps, are the narratives of conquerors more interesting than the plain tales of those who, by the virtue of their designs alone, have improved the condition of mankind. The merits of William Penn have long been justly venerated; and the high moral character of the Pennsylvanians even at this day, in the United States, is the fairest monument that wisdom and enterprise can hope to obtain. The earl of Selkirk's exertions to provide for "a gallant and hardy race of men*," whom a coercive change of manners and the abolition of antient customs had deprived of their homes and hereditary importance, will also be commemorated with respect, when the derision with which they have been treated is forgotten, and the opposition which distorted his original design is remembered only to be contemned. His lordship's lands in Upper Canada were granted, like the other townships, on condition

* Lord Chatham's description of the Highlanders.

that within a limited period they should be settled with inhabitants; a principle calculated to excite that very spirit of emigration in others for which his lordship has been so inconsiderately blamed, and which he only endeavoured to regulate for ultimate benefit to the empire. He has built a village for the Highlanders, and they are now very comfortably established. Soon after their arrival a disorder similar to the jail fever broke out among them, and carried off a considerable number; they have since, however, participated in the general healthiness of the climate. His lordship, by importing Spanish and English rams, has improved the breed of his sheep; and he has already obtained wool equal to the best English, in some instances perhaps a superior quality. At no very distant period we may therefore presume that Canadian wool, as well as hemp, will become a staple article of commerce.

The use of tobacco has considerably abated in Europe, and perhaps universally; but as in many situations it is found a salutary and preventive medicine, it is likely to continue still a respectable branch of American commerce. It grows luxuriantly in the western district, and may therefore be regarded as one of those productions which in time will constitute the principal exportable commodities of the province. It is also probable that Canadian wines will be added to the variety of European luxuries; for the vine throughout the whole country is surprisingly fruitful, and the grapes uncommonly delicious. The mineral riches of Upper Canada are little known, nor has it ever been supposed that the precious metals were to be found there. Accident, however, has led Mr. Gilkison to believe, that, if judicious investigations were instituted, gold might be discovered in the country beyond the Lakes. One day an Indian brought to him a quantity of a very heavy substance resembling the filings of a metal, and which he, as well as those to whom it was shown, conceived to be gold. Mr. Gilkison brought this specimen with him for the purpose of ascertaining its value; but it was lost along with luggage in the shipwreck of the vessel by which he came to Britain. The Indian assured

sured him the dust could be obtained in great abundance, and that next year he would return to Amherstburgh with a larger quantity.

A society has been formed for the encouragement of the commerce and agriculture of the province; and the legislature, last year, voted 400*l.* to procure a philosophical apparatus, to be placed in the most populous and central district; a grant of 1200*l* was also made for the improvement and making of roads. When it is considered that the population does not exceed 40,000 souls, so liberal a disposition in the provincial legislature is certainly calculated to improve the character of the people, who may be described, at present, as a composition of all nations, kindred, and tongues. The Dutch farmers are eminently distinguished for their industrious inclinations, but the settlers from the United States are the refuse of their own country; they are nevertheless, however, excellent axe-men, and wonderfully active in clearing the forests. The French of Upper Canada are an indolent and thoughtless race; their attention is only exerted towards objects of amusement, and they appear but slightly affected by that kind of ambition which incites the rest of mankind to improve their condition. The Scotch Highlanders can hardly yet be regarded in any respect different from their well known character in Britain.

Religion.—The established religious discipline of Upper Canada is that of the English church. The clergy are governed by the bishop of Quebec. Their salaries, however, are paid by the state, as the lands allotted for ecclesiastical purposes are still inadequate to support them. By this mode of paying the clergy, those parochial feuds, which so often disgrace the priesthood elsewhere, are prevented. Exclusive of the allowance from government, the Missionary Society gives a small stipend, which makes the amount of the salary to each minister about 200*l.* per annum. It would be improper to dismiss this article without noticing a very extraordinary innovation on the tything system, which has been made by the British government. Instead of the tenth of the produce, a tenth part of the land in every allotment is reserved

reserved for the future maintenance of the clergy. But no provision is made for a capital to stock or cultivate the *tything*. The innovation seems only calculated to perplex the future pastors as well as their flocks, unless the legislature previously examine the validity of tythes in general.

Schools.—Several attempts have been made to establish township schools; the want, however, of funds has hitherto proved an insuperable objection. Lands, upon the same principle as the ecclesiastical, have been reserved for this purpose; but while the population of the country continues so thin, such local provision for the master will not be sufficient. There is reason to hope, however, that district schools will soon be instituted, when, besides fees from the scholars, it is supposed that salaries will be granted from the revenues of the province.

Missionaries.—The Missionary Society of the United States have sent their agents amongst the Indians; but, with the exception of the Quakers, few have succeeded in producing even a disposition to moral or intellectual improvement. In only one village, Mr. Gilkison said, had their labours been attended with any visible success. It is situated on the river Thames in the western district, and the Indians are of the Delaware nation. Several of the inhabitants read, and also write a little; they attend church regularly, where sermons in their own and the English language are delivered on Sundays. The women sing the psalms and hymns with a respectable degree of skill, and drinking is almost universally abandoned; which is the grand previous step to furnishing the Indians with the means or the matter of knowledge.

II. *Summary Considerations upon variegated Colours of Bodies when reduced into thin Pellicles; to which is added an Explanation of the Colours of tempered Steel, and of those of Peacocks' Feathers. Extracted from a Work on Colours; by* C. A. PRIEUR.

[Concluded from p. 339.]

I SHALL conclude with some observations upon two kinds of curious phænomena analogous to my subject, and of which I think myself warranted in giving an explanation different from that generally admitted.

The first subject I allude to chiefly concerns the colours of tempered steel.

Newton has ranked them among those dependent upon coloured rings, not from any special examination, but by a simple consequence of the system he founded, and supposing that the metallic particles must change in their size from the action of the fire*. Beyond this he did not look, in order to ascertain if there were other causes to take into the account.

Some more recent inquirers, on the contrary, have, without hesitation, attributed these colours to a varied degree of oxidation†, because they thought they saw a great similitude between the appearances in question and those of several metals placed in circumstances in which they were in fact oxidated. This subject at least merits a closer examination, and I adopted the following simple method to elucidate it.

I placed a steel watch-spring in the flame of a candle, and heated it for a few minutes in a fixed position. Having afterwards taken it out, I found, upon cooling and wiping it, that there was to the right and left of the central point, where the flame had acted, a series of coloured gradations with periodical returns, such as would have been exhibited

* Optics, book ii. part 3. prop. 7.

† Independently of several authors who have adopted this prejudice with respect to oxidation, we see it exhibited, in a recent publication, full of interesting views and observations, with the exception of this doctrine alone. See in Nicholson's Journal for June 1800, a report upon fine cutlery.

by a small ribbon cut precisely in the midst of a circle formed of a series of concentric coloured rings. The nature of the phænomenon, therefore, was here manifested very distinctly; for the exterior ring was nearly three centimetres in diameter, and the others decreased interiorly, with intervals of some millimetres. Nothing was wanting to complete the figures but to operate upon a large plate of steel, suspended horizontally above the point of the flame; in this case, I should certainly have obtained entire circles of rings.

I did not happen to have such a large plate of steel at hand, but I made use of a sheet of tinned iron, which, with appearances analogous to the preceding, gave very brilliant colours, on account of the natural white of the substance. When looked at in a proper direction the colours appear still more lively, viz. chiefly yellow, red and blue, which form together a spot in which the blue occupies the centre, surrounded with red, and beyond that again yellow, with intermediate gradations of shades.

Nothing in the faculty possessed by tin of oxidating and forming salts, indicates any thing like colours corresponding to the above; in addition to this, the periodical streaks upon the steel watch-spring evidently belong to a series of rings; we must therefore conclude that this phænomenon belongs simply to the class of coloured rings.

Another experiment made upon a gold ring also produced repeated traces of rings; and in this case, the idea of oxidation is almost out of the question.

A copper wire gave me similar appearances, although more feebly; but I have remarked them very distinctly upon this same metal when made into the flues of stoves. Lead, when we melt it, also exhibits these sorts of colours when cooled, even upon its inferior surface, not exposed to the contact of the air.

With respect to the action exercised by caloric upon the metal in these various examples, I shall not assert that it has altered the size of the particles; for how can we conceive that a substance can, without becoming of another nature, vary in the disposition of the constituent elements of its molecules? But I can more easily comprehend that there

there has been a progressive separation of molecules, increasing, as in the case of my steel watch-spring, from the spot scarcely reached by the heat to that which immediately touched the flame. This movement, according to the principles I have laid down, must have been sufficient for the production of the rings.

We daily see many other examples of these kinds of colours, the arrangement of the particles of which seems to be the sole determining cause. Such are the stains formed upon steel knives by the acid of fruits; the black colour assumed by silver plate from sulphurous emanations, or from the prolonged contact of certain substances; and in chemical laboratories, the rainbow-coloured pellicles formed at the surface of liquors containing some matter which has been first dissolved, and afterwards separated by the progressive evaporation of a volatile principle. The water of dunghills is also covered sometimes with similar coloured pellicles.

Now all these effects, whatever be the nature of the matter primitively or secondarily formed, arise wholly from the arrangement of the parts. Nothing is so easy to be ascertained. Scrape the surfaces, rub the pellicles, and all these colours are annihilated, and there remains nothing in the fragments of each substance, except particles uniformly possessing properties essential to their species.

The following, among others, is a very convenient way of observing these effects. I take a small quantity of the green of Scheele and dissolve it in an acid; after having diluted this liquid in a considerable quantity of water, I precipitate by an alkali, and add ammonia, merely for the purpose of redissolving the precipitate: leaving the whole afterwards in an uncovered vessel, I find, after a few days, the surface of the liquor covered with an iris-coloured pellicle, very apparent, and in which we even distinguish a succession of rings, if the liquid has not been disturbed. I then remove this pellicle, by slipping a sheet of paper or a piece of glass under it. The colours of the pellicle continue to be visible after its removal; and upon allowing the substance to dry slowly, we may thus preserve them an indefinite time

time in all their brightness. But when we come to pass the finger slightly over this pellicle, nothing but a green powder is obtained; the red, yellow, blue, and purple colours, which were so brilliant, disappear in an instant.

My second phænomenon is relative to the changeable colours of the plumage of the peacock and some other birds, such as the cock, the pigeon, the duck, and the turkey. Here, after the most attentive comparative examination and the most circumspect reflections, I ended by renouncing the idea that these kinds of colours could be referred to rings. My conviction is founded on the following grounds:

I first considered that these colours were not the necessary result of a certain tenuity of the parts; for, on the one hand, several animals certainly present in their hair, their feathers, or in the down which covers them, examples of tenuities varied to the most imperceptible degree, and yet without there being any production of colours. Is not the white peacock itself a striking example of this?

On the other hand, have not several birds and insects colours immoveable in their position, and in their reflections, when viewed under every inclination whatever? The wings of some butterflies have very fixed colours, although depending upon a down so very minute that it is hardly perceptible. It is also proper to remark, that all these colours indicate opacity, like those of the peacock's feathers; with this difference, that in those of the wings of flies we perceive the shades relative to the coloured rings; but these membranes have a sensible transparency, like scales of mica or blown glass.

I afterwards observed the changes of colours in several feathers of the birds mentioned. In those of a peacock's tail, we see upon the lateral beards of the stalk, when we change their position, the red changing very suddenly to the green. The red takes place in consequence of the almost perpendicular reflection of the light; the green, in consequence of a very oblique reflection; and there is no alternative of reflection and of transmission; the opacity of which I have spoken above does not admit of it.

Near the eye of the feather an exterior corona exhibits yellow

yellow shades by a perpendicular reflection, and greenish by an oblique reflection; while, more interiorly, by the same change of obliquity, a space of the most lively green assumes the new shade of the violet. Such are the principal mutations of these colours, consisting of two shades only for each spot.

Upon a feather from the neck of a pigeon the disposition is quite contrary to that of the lateral beards of the peacock's tail; *i. e.* in the same circumstances one of these feathers gives red, while the other gives green, and *vice versâ*.

It is very difficult to reconcile this alternation of colours, confined to two principal species, with the variety of shades which the coloured rings would seem to give by means of a substance of a density so feeble as that which constitutes feathers. Should we attempt to draw an inference from the more sensible changes which the feather of a pigeon presents in its shades, this would still afford but a deceitful analogy: these changes proceed only from the generally bent state of the feather, since they cease when we lay it against a flat surface.

But what forms a total disparity is the appearance of the feathers of the wing of a duck. Here the transition takes place from green to blackish; and again, this green colour is not sensible, except in peculiar positions, where the incidence and reflection of the light take place under very unequal angles, as, for example, when we view the feather under a certain obliquity, having our back turned to the light. Do we never see any thing similar in the succession of coloured rings?

I thought, lastly, of carefully moistening several places of the region of the eye of my peacock's feather. I then saw, not a weakening of the first shades, but new colours emerging with a good deal of strength. I was anxious to know if I could not produce permanent alterations by some solvent: I consequently tried to moisten it successively with saliva, with vinegar, weak and strong muriatic acid, with ammonia, ether, alcohol, and with a solution of muriate of lime; and I ascertained that these agents had no other influence

fluence than that of any humid matter, all of them nearly in an equal degree, the concentrated acid however excepted, which gave some difference; but all these effects ceased almost in the same manner upon drying.

When the exterior orbit of the eye was moistened, its yellowish colour became of a lively blood red colour, and the reflection, primitively green in consequence of its obliquity, was almost extinct. If we moistened the green space within the circle, it was the violet reflection which this time disappeared. Lastly, by the smoking muriatic acid, this same green space gave perpendicularly a yellow colour strongly inclining to the red, and the oblique reflection at first a green and afterwards a violet colour: at no time did any of these alterations continue.

Upon also moistening the extremity of the tail feathers of a turkey, I obtained some new and very lively colours, which we could not previously see in the same direction, but the existence of which was indicated to me by certain reflections against the light, analogous to what I have mentioned when speaking of the feathers of the duck.

It was impossible for me, after all these particularities, to persist in ranging, under one and the same system, the changeable colours of the feather and those of the coloured rings of pellicles. An examination of the latter, several times repeated, induced me to think that they might proceed from the super-position of several coloured matters, sometimes of two only, or of three or any greater number, nearly as if, wishing to paint a body of several colours, we should cover it successively with a coat of each of the proposed ingredients.

This supposition, properly adapted to each part of the feathers, accounts very feasibly for all the appearances we observe in them.

In short, if, for example, upon a coat of painting, formed upon a green substance, we spread in a thin coat a violet colour not very abundant, it will be evident that upon looking perpendicularly at the painted surface it will appear almost uniformly green, while upon lowering the eye to render the visual rays more and more strong, the colour will become

become progressively predominant, until it be, in its turn, the only colour perceived. The intermediate hues will be different degrees of green, to which will succeed various degrees of blue before arriving at the violet shades: all this may be easily conceived.

If, moreover, the green substance is itself placed above a red matter, the latter will not be visible in the intervals of the coloured matters of the upper layers; but if these coats come to acquire transparency by the imbibition of a liquid, in this case the influence of the undermost layer will be sensible, and will necessarily manifest itself in this case by a yellow or even a reddish colour, when viewed perpendicularly, while the oblique reflections will give greenish and violet-coloured hues. The drying of the substances will afterwards restore things to the first state of which we have spoken.

Such in reality are the variations of shades of certain places of the feathers of a peacock. Such, in my opinion, is the probable cause of their formation; applicable also to those of the cock, the pigeon, and several other birds and insects; and in particular to that magnificent butterfly with large wings, which through their whole surface present a brilliant green, converted gradually, by means of obliquity, into a still more beautiful violet colour *.

III. *Upon the most sensible Re-agents with respect to the Muriatic, the Carbonic, the Sulphuric Acids, and Ammonia. By M.* Pfaff, *Professor of Chemistry at Kiel* †.

In experiments upon the supposed formation of the muriatic acid in water by the influence of the Galvanic pile, it is certainly of great importance to possess a re-agent of great sensibility with respect to the above acid, in order to

* The author might also have drawn inferences illustrative of his subject from those silk and worsted stuffs which are woven with their weft and woof of different colours. These always exhibit the one or the other colour, according to the angle under which their surface is viewed.—Edit.

† From *Annales de Chimie*, tom. lxii. p. 19.

be able to discover its first traces and to follow its successive increase. Hitherto nitrate of silver has generally been used. This re-agent is, without doubt, extremely sensible as to the above acid. Kirwan asserts that we may discover by this means one part of the acid diluted in 108,333 parts of water. But this re-agent is still far surpassed by the solution of the mild nitrate of mercury prepared in the cold way. One part of muriatic acid, of 1150 in specific gravity, diluted with 70,000 parts of water, is scarcely announced even by a feeble opalization; when diluted with 80,000 times its weight of water it eludes the action of this test, as it does all the others, except the mild nitrate of mercury, which last affects very sensibly the water thus feebly acidulated. The sensibility of this re-agent is so great, that even $\frac{1}{300,000}$dth of a grain of muriatic acid at 1150 is indicated by a slight dull shade in the water which contains this almost inconceivably small quantity. Reflecting upon the almost absolute insolubility of the mild muriate of mercury, I was induced to make some experiments concerning this re-agent.

It is also the most sensible agent for ammonia. One part of this latter substance diluted with 30,000 parts of water is announced by a slight blackish yellow shade, upon adding solution of nitrate of mercury at the minimum of oxidation.

Lime water, or water of barytes, are generally regarded as the most sensible re-agents for carbonic acid. I discovered, however, that the solution of acetate of lead still surpasses them. I was accidentally led to this remark :—some distilled water, which I had preserved in a deep cellar, where there were no fermented liquors, was very sensibly affected upon adding this solution. No other agent changed it. Kirwan has asserted that the acetite of lead is a deceitful re-agent, its solution, chiefly when a little old, being sometimes affected with pure distilled water. But it is not so fallacious, however, as he imagines, because distilled water always contains a little carbonic acid, is never pure. I prepared distilled water exempt from all carbonic acid. It was not affected either by lime water or by the solution of acetite of lead. I poured some drops of carbonic acid into it. The water

was

was so feebly acidulated by it that it did not redden turnsole paper at all, and did not affect lime water. But the solution of acetate of lead became sensibly white. The acetate of lead is much less sensible with respect to the other acids. A solution of sulphuric acid of 1850 diluted in 10,000 parts of water, which acts also very sensibly upon turnsole paper, is not at all affected by the acetite of lead. Water of baryte discovers even $\frac{1}{70,000}$dth of its weight in water acidulated by the sulphuric acid, and surpasses in sensibility all the other re-agents with respect to this acid.

The mild nitrate of mercury is also a re-agent almost equally sensible for the phosphoric acid as it is for the muriatic; with this difference, that the precipitate by the former is dissolved in an excess of phosphoric acid or nitric acid, while the precipitate by the latter is absolutely insoluble by an excess of any acid whatever.

IV. *Some further Remarks upon the supposed Formation of Muriatic Acid in Water by the Influence of the Galvanic Pile. By Professor* Pfaff*.

I have continued, since my first communication in the *Annales de Chimie*†, my inquiries upon the supposed formation of the muriatic acid in water by the influence of the positive pole of the pile of Volta. I made use of glass tubes of different diameters from a line to an inch; the tubes were closed below, except a small hole in which the metallic conductor wires were fixed with sealing-wax. The communication between the two tubes, into one of which was conducted the influence of the positive pole, while the influence of the negative pole was communicated to the other, was effected at the top, sometimes by moistened paper, sometimes by linen threads, sometimes by nerves, and sometimes by animal fibres. I even varied the metallic wires. I employed successively wires of platina, gold, silver, copper, and iron. I never obtained a trace of muriatic acid, al-

* From *Annales de Chimie*, tom. lvii. p. 23.

† See Phil. Mag. vol. xxvii. p. 328.

though my most sensible re-agent for that acid (being the solution of mild nitrate of mercury) would have announced even $\frac{1}{300,000}$dth of a grain of that acid. But I obtained by turnsole paper some traces of an acid which certainly was neither muriatic, sulphuric, carbonic, nor phosphoric acid, since the most sensible re-agents for these acids, which far surpass turnsole paper, did not announce them: it was therefore, in all probability, nitric acid; I always obtained traces of an alkali, which, after all my experiments, was ammonia. I therefore still adhere to my opinion, that the acid and the alkali are formed at the expense of the azote inherent to the water, on the one side by oxygen and on the other by hydrogen.

V. *Essay upon the Art of the Foundry among the Antients: with some Remarks upon the celebrated Horses of Chio, now brought from Venice to Paris.* By M. Seitz.

[Continued from vol. xxviii. p. 354.]

History of the Horses of Chio, and some Observations upon the Question of what School they belong to.

This medal of Nero (Plate I.) was struck upon the occasion of the victory gained by Corbulon over Tiridates, king of Armenia. It represents a triumphal arch surmounted by a quadrigæ, the horses of which have always been regarded as identically the same horses of copper gilt, which our victories have obtained to us, and which now decorate the palace of the Thuilleries. The manner in which they lift their feet and carry their heads, and indeed their whole attitudes, have greatly contributed to give weight to this conjecture, which has been adopted by Maffei and all the Italian authors *. They have gone still further in sup-

* The four horses of Venice are about to be placed in the same situation as those mentioned by the author of this memoir; they will be yoked to a quadrigæ which will bear the figure of the emperor and king Napoleon the Great, and is to be placed upon the triumphal arch which decorates the entrance of the Thuilleries:—this gate, with the quadrigæ, are exhibited upon a fine medal struck for the purpose, and of which there is an engraving in my *Histoire Métallique* of the emperor Napoleon.—*Note by M. Millin.*

port

port of this opinion, upon the authority of historians, who inform us that Constantine the Great stripped Rome and the cities of Greece of their finest ornaments in order to decorate his new capital *. We may conclude that these four horses were comprised in the above, if we give credit at the same time to an antient tradition, which, however, never existed except in the imaginations of some learned men. Zanetti, who has added an engraving of them to his collection of the statues at Venice, even thinks he has discovered some defects in their workmanship; and for this reason he concludes them to be of Roman origin. It is, however, very certain, and we may refer to the authority of Codinus as a confirmation, that these horses were never at Rome. They were found by the Venetians in the great circus of Constantinople. It is among the antiquities of this last city, therefore, that we must seek their origin, and not among the monuments of Rome. Codinus, who enters into a long detail upon the subject of the antiquities of Byzantium,

* The exorbitant sums of money expended by Constantine in order to transform Byzantium into an agreeable residence for the Romans must excite our astonishment. Theatres, circuses, public baths, porticoes, temples, palaces, gymnasia, triumphal arches, aqueducts, columns surmounted by statues, obelisks, cloacæ, were all constructed with as much magnificence and with more regularity than in antient Rome. In order to induce twelve of his friends to reside in his new capital, he first sent them with an army against Sapor, king of the Persians. In the mean time architects were dispatched to take all the dimensions of their houses at Rome; and in order at the same time to induce their families to come to Byzantium, the houses at Constantinople were built exactly upon the same plan, and with all the accessaries of luxury they possessed at Rome; and when, at the end of 16 months, the patricians returned from their expedition, the emperor asked them jocularly if they intended to return soon to Italy.—"In two months," was their answer; "at the beginning of winter we intend to set out."—"In the mean time (said the emperor) I have prepared lodgings for you." When they were conducted to them, how great was their astonishment upon seeing transported, as if by enchantment, their palaces from Rome to the shores of the Propontis; and they were much delighted when upon entering them they found assembled their wives and children, with their slaves and every thing that was dearest to them. Codinus, who relates this story, enumerates 22 cities from which Constantine brought away statues. The church of St. Sophia, which was as yet no better than a pagan temple, received 427 of these works of art. Justinian, who consecrated this magnificent temple to the Christian worship, took the statues out of it, and distributed them in the different quarters of the city.

speaks of a car with four horses, which was antiently in the place called Milium. These four horses were gilt: they seemed to be at full gallop, and as if drawing the statue of the Sun. Constantine caused this chariot, accompanied by its guards, to be transported into the hippodrome, or grand circus*, in order to celebrate the festival of the Fortune of Constantinople, which he represented by the statue of the Sun. After this solemnity the chariot was carried back with the same escort to its antient station. This chariot with four horses has nothing in it similar to the four gilt horses which the same author speaks of† when he specifies all the monuments in the hippodrome or circus; the latter were placed upon the barriers, and not yoked to any chariot; and Theodosius the younger had them brought from Chio to Constantinople. They were the only horses that were in the Circus; for had there been other quadrigæ, Codinus

* Codinus, Origines Constantinopolitanæ, p. 19.

† Codinus, lib. c. p. 28. Οἱ δὲ τεσσαρες κεχρυσωμενοι ἱπποι, οἱ ὑπεμβεν των καγκελλων ὁρωμενοι εκ της Χιου ἠκασιν επι Θεοδοσιου τυ μακρυ. Καγκελλοι. are what the Romans call *carceres*. It means the place where the horses were confined before they started in the race. A passage of Nicetas Choniates, where these same horses are mentioned, deserves to be mentioned here: he informs us that one Agaremis proposed to fly from one end of the hippodrome to the other: "*Suæ sponte hippodromi turrim conscendit, sub qua carceres sunt unde emittantur equi; supra* (*carceres*) *vero quatuor equi aurati stant*, collis incurvis obversi sibi invicem, *alacritatis ad cursum pleni seque stadium transvolaturum jactat.*" The attitudes are here so distinctly described that they cannot be mistaken.—*Note by the Author.*

On the contrary, in my opinion, the very attitudes furnish the best reasons for doubting that the four horses now in the Thuilleries were really those of Chio. Their step appears composed, and not at full gallop; they do not throw up their heads like fiery steeds: from all which circumstances, although the passages of Codinus, Nicetas, and other authors of the lower empire have been extremely well known, no person can take upon him to assert in a positive manner, as the author has done, that these horses are the same as those of Chio. In no view whatever can we suppose that they were yoked to a chariot, and we know from the report of Nicetas, that there were several figures of horses in the hippodrome. This is the reason why M. Heyne,—in his elegant dissertation *Prisca Artis Opera quæ Constantinopoli fuisse memorantur*, Memoirs of the Göttingen Academy, vol. ix. p. 36,—also thought that these horses are not those from Chio: this, however, has not been demonstrated any more than the other proposition. The opinion of M. Seitz, the author of this memoir, with respect to it, has a good deal of probability, and it is developed with much interest.—*Note by M. Millin.*

would

would not have failed to mention them. I concluded, therefore, with good reason, that these were the same gilt horses which the Venetians found in that place 800 years after Theodosius II., and saved from destruction by taking them to Venice. It is probable that Codinus has drawn this notion from their inscription; for he says that each statue of the Circus had its inscription, which mentioned from what city it had been carried off.

The resemblance of these horses with those upon the medal of Nero, can be no objection against the authority of Codinus. The antient world was so filled with similar works, and the chefs d'œuvres of the great masters were so often imitated, that one quadrigæ might often resemble another.

The Isle of Chio, at present called Scio, is situated between Samos and Lesbos. It produced the best wine in Greece; it had a city of the same name, which was bounded by Mount Pellenus on the land side, and on the sea shore there was a harbour which contained eighty vessels. All these natural advantages induced the inhabitants to apply early to navigation and commerce; they traded with the Egyptians in the reign of king Amasis, who permitted Greek merchants to settle in Egypt, where they made establishments in common with the Rhodians, the Cnidians, the inhabitants of Halicarnassus and Mytilene.

In the war undertaken by the Greeks of Ionia against Darius, the son of Hystaspes, they furnished ninety ships. In the naval engagement with the king's ships, the Lesbians, the Samians, and all the others fled; but the inhabitants of Chio preferred perishing rather than imitating the disgraceful conduct of their allies; at last, after having performed prodigies of valour, they gave way to the numerous fleet of the Persians. Victims to their zeal for the common cause, they were also crushed by the perfidy of their neighbours. Histius, of Lesbos, who had embraced the cause of Darius, in company with the Lesbians made a descent upon Chios, attacked the people already enfeebled, killed an immense number, and gave the island up to pillage. They were never able to recover from the effects of these disasters; for we find that in the war against Xerxes, the son of Darius,

they were only able to furnish four ships, and they had only seven in the battle of Salamis.

When after that battle Xerxes retired into his own states, the Chians once more enjoyed their antient freedom, by means of which they recovered themselves so quickly, that in the time of the Peloponnesian war they had sixty ships at sea, and their capital was regarded as one of the grandest and richest cities in Greece *. During this war they were always strongly united with the Athenians; but when the latter were defeated in Sicily, they quitted their cause in order to embrace that of the Lacedemonians. This measure, which Thucydides seems to approve of as being very prudent, nevertheless became the cause of new misfortunes. The Athenians besieged their city, overcame them in several engagements; and their island, which had become so flourishing since their struggle with the Persians, was again a prey to all the scourges of war. At last, however, the Athenians were conquered, and quitted their country. From this time these islanders lived in tranquillity; but they were stripped of their antient splendour. The Lacedemonians, their new allies, rendered them tributary in order to contribute to the expense of their numerous expeditions †.

Commerce had been banished from them, and they were too enfeebled to act any part in the affairs of Greece. History loses sight of them until the 105th Olympiad, when they united with the inhabitants of the island of Cos, the Rhodians, and the Byzantians, against the Athenians, in order to revenge some particular outrages they thought they had received from Chares their general. This war lasted three years, and it was known by the name of the social war.

Under Alexander they became the sport of fortune, and they attached themselves, according to the exigency of the moment, at one time to the nearest and at another to the

* Thucydides, lib. vi.

† Xenophon, lib. ii. It was probably from the Lacedemonians they adopted the practice of making young girls wrestle with boys in the Palæstra. Athenæus says that it was with much pleasure people went to Chio to witness this charming spectacle, lib. xiii.

strongest.

strongest. In the war of the Ætolians with Prusias, king of Bithynia, and Philip of Macedon, they were again maltreated by these two kings, and their city was taken and devastated. When the Romans acquired preponderance in Greece and Macedon, they placed themselves under their protection; but being too far off to be always vigorously defended, each new war presented them with the sad perspective of new misfortunes. The sovereigns Enmenes and Attalus treated them well; but Mithridates made them feel the dreadful effects of his anger. At last Sylla, his conqueror, gave them their liberty and received them among the friends of the Roman people. From friends they became subjects, and under the emperors the beautiful women of Chios flocked to Rome in order to display their musical talents, and at the same time to make a traffic of their charms *. After the division of the empire, the destinies of this country were united to the empire of Constantinople until the year 1207, when this same island, which had formerly ruled the ocean, became the property of a single Venetian.

The history of the prosperity and adversity of a people forms at the same time the history of the arts they exercised. The Muses delight in tranquillity, and shun the unfortunate. The æra of the greatest riches and prosperity of the island of Chios, commences with the 30th and ends with the 92d Olympiad. It was at the commencement of this period that the arts of Asia Minor were communicated to the islands of the Ionian Sea.

The most antient statuary of Chio was Melas, who must have lived between the 30th and 40th Olympiad. His son Micciades, and his grandson Anthernus, became celebrated in the same art. Anthernus had two sons, Anthernus and Bupalus, both of whom attained the greatest celebrity, and were cotemporary with the poet Hipponax †. The neighbouring

* Horace, lib. iv. ode 13.

——— ——— *Cupidinem*
Lentum solicitas. Ille virentis, et
Doctæ psallere Chiæ,
Pulchris excubat in genis.

† Plin. lib. xxxvi. § 5. This Hipponax lived in the 60th Olympiad. As he was

bouring islands of Chio, Delos, and Lesbos, were full of their works; and in Chio was to be seen a Diana by Bupalus. All these sculptors made use of the beautiful marble of Chio; but we do not see that they wrought in bronze. It would be pushing the mania for antiquities too far to pretend to name the artist who made the horses of Chio; but if the examination of a monument which time has spared, added to the descriptions of those which antiently existed, can still suffice for distinguishing the different schools, such an inquiry will not, perhaps, be without interest in the history of the arts.

We must not imagine we see in these horses a chef d'œuvre of antient art. So early as the time of Cicero all that was valuable in the island of Chio had been brought to Rome in order to decorate the houses of the rich *. The emissaries sent by Nero into Greece, in order to carry off all the works in bronze they thought worthy of decorating his edifices, although they did not neglect to visit the islands of Rhodes, Samos, and Chio, yet they did not meddle with these horses; nor were they comprised in the general requisition made by Constantine of all the objects of art, which might adorn his new residence; it was only under Theodosius II., when the world was already stripped of all the chefs d'œuvres, that they were thought worthy of being transported to Constantinople. Would they have remained so long in their places; would they have escaped the rapacity of the Roman governors, the depredations of Nero, and the requisitions of Constantine, if their workmanship had been fine enough to charm the eyes of connoisseurs, or to entitle them to be compared to a work of Calamis, Lysippus, or an artist of the school of this grand master?

was very plain in his person, these two sculptors amused themselves at his expense, by exposing to public view a ridiculous caricature of him. Hipponax, indignant at seeing himself the object of the insolence of the pub. c, made a poem, and satirized them so unmercifully that they repented their temerity in ridiculing the son of Apollo. It must be observed that this Bupalus is not the same with him who flourished in the 107th Olympiad, and wrought at the monument erected by Artemisia to Mausolus, and whose works, brought to Rome by order of Augustus, were thought worthy of being compared to those of Praxiteles. The great distance in point of time is a proof of this.

* Septimius Verrinus, cap. 48.

Lysippus

Lysippus lived in the time of Alexander, a period when the inhabitants of this island had neither enough of riches nor tranquillity to decorate their city with works of art. Besides, the style of the design and of the sculpture by no means answers to that of Lysippus; his horses were lighter, their manes floated in long tresses, in order to indicate the swiftness of a race. It was here he displayed his talents for working tresses of hair, which he expressed so naturally and so gracefully as to charm every eye. The horses of Chio are in a heavy style; their design represents strength rather than agility; their manes appear as if cut, which proves that the artist did not know how to design horses; at least, we may see from the ringlets of their tails that he was not very expert at this kind of work. Their heads, however, deserve our admiration; their nostrils extended and their foaming mouths seem to breathe the fury and impetuosity of the horses of the sun; and, without leaning too much to conjecture, we may say that we find more in them of the style of Polycletes and Miro* than that of Lysippus. The works of these two artists were vigorously designed; we perceive in them starting muscles, and in general more strength than gracefulness. Neither the one nor the other knew how to work tresses of hair, and both of them lived at a period when the inhabitants of Chio were in a state of profound peace, and enjoyed a kind of naval superiority. They were enriched by commerce, and had consequently leisure and the means of thinking of the embellishments of their capital. This period lasted from the 75th to the 92d Olympiad: it comprehended a space of 70 years, and was the happiest time this city ever enjoyed. If we fix upon this æra as that in which these horses must have been founded, they would now be 2248 years old†. They would thus be more antient than any other bronze monument we know of, and they must have existed in the

* This conjecture seems to us too daring; for we have no evidence whatever in modern times as to the particular style in which the animals of Myro or Lysippus were executed.—*Note by M. Millin.*

† It seems impossible to assign so distant an æra to these horses; they rather seem to have been moulded at a time when the art had begun to decline.—*Id.*

time

time of Thucydides, Alcibiades, Herodotus, Pericles, Sophocles, Euripides, Socrates, Hippocrates, and Plato.

If in the days of Cicero * a middling-sized bronze statue was worth 120,000 sestertii, which is more than 12,000 francs in French money, what price shall we put upon this unique piece of antiquity, which, among the whole of similar works, with which the antient world was filled, alone escaped universal destruction?

The horses of Chio were cast in copper and gilded. We know that copper is better adapted than bronze for receiving gilding, and it seems they were originally intended to be gilt †. It is wrong, therefore, to reproach the Romans with their decided taste for gilding, since the Greeks also gilded their quadrigæ. It is, however, certain that the fine bronzes were not gilt. Their colour was fine enough to make this ornament to be dispensed with, as we have seen. Lysippus would have been vexed to have seen that by gilding his works, the exquisite finishing, which formed his chief merit, was concealed. We see in Pliny ‡ how much Nero was blamed for having caused this artist's statue of Alexander to be gilt, and how much the connoisseurs regretted to see a Venus by Alcamenus covered with gold. When we read in Pausanias § that there was at Delphos a gilt statue of Phryne, executed by Praxiteles, and that the Athenians had dedicated at Delphos a gilt Minerva on the occasion of a victory they had gained, we must be of opinion that this practice of gilding proceeded from motives of emulation, and in order to approach, as much as possible, the magnificence of the other

* In Verrem, orat. 4. c. 7.

† Vitruvius, lib. iii. cap. 2, says that it was usual to ornament the fronts of temples with statues of copper gilt in the Tuscan fashion, as we see in the temple of Ceres and Hercules near the Grand Circus; this passion of the Romans for gilding was therefore of Etruscan origin. According to Buonaroti, *Osservazioni sopra alcuni Medaglioni*, p. 370, the gold employed by the antients in fire-gilding was, in the proportion of gold employed in modern gilding, as 6 to 1; and for common gilding their gold leaves were as 22 to 1. All the antient gilding found below-ground has still its natural lustre, and we might have been able to say the same of the gilding upon the horses of Chio, if it had not been almost entirely scraped off.

‡ Lib. xxxiv.

§ Lib. x. cap. 15.

statues of massive gold which were in this temple. As to the quadrigæ, it seems they were always gilded when yoked to the chariot of the Sun, in order that the lustre of the gold might imitate the splendour of that orb. The four horses seen at Constantinople harnessed to the chariot of the Sun, were also gilded. The island of Rhodes adored this divinity, whose worship naturally extended to the other islands of the Ionian Sea; and it is very probable that the four horses which now decorate the palace of the Thuilleries were formerly yoked to the car and statue of the Sun.

[To be continued.]

VI. *Facts for a History of the Gallic Acid.* By M. Bouillon-Lagrange.

[Concluded from vol. xxviii. p. 297.]

Examination of the Action of Caloric and Water upon Gall-nuts.

Action of Caloric.—M. Deyeux having examined, in a particular manner, all the products of distillation of gall-nuts in the open fire, I only considered the acid liquor obtained from this substance.

This operation was conducted in the manner pointed out by this chemist: the liquor of the receiver was aromatic, a little milky, very acid; did not precipitate glue, and gave with the sulphate of iron a violet blue passing to the dirty green. Lime and barytes yielded a colour of pea blossoms. The nitrate of mercury formed a blackish precipitate in it; it was white with the acetate of lead and the muriate of tin.

I saturated the acid liquor with potash; I obtained by evaporation a brown empyreumatic matter, which by the addition of the sulphuric acid exhaled a pungent smell analogous to that of the acetic acid.

Action of Water upon Gall-nuts.—I shaked, for four minutes, gall-nuts in fine powder and in cold water; the liquor, after having been filtered, was of a golden yellow colour: one part was distilled in a retort placed in a sand-bath, the other was saturated by means of the carbonate of soda.

The

The produce from the distillation was a limpid liquor, colourless, and slightly acid, neither precipitating glue nor sulphate of iron.

The liquor saturated by the alkaline base was evaporated to dryness: being afterwards dissolved in distilled water, sulphuric acid was added until it was slightly in excess, and it was distilled in a retort; the produce was successively examined: a liquid, without taste or smell, first came over; soon afterwards the liquor was acid, and contained neither sulphuric nor gallic acid.

I made a similar experiment with boiling instead of cold water: the liquor remained always turbid, although filtered; when submitted to distillation and combined with soda, I obtained the same results.

These experiments suggested to me the existence of an acid ready formed in galls, and the possibility of obtaining it by distillation.

Accordingly I heated to ebullition in a common alembic a kilogramme (2 lb. 3 oz. 6 dr. avoird.) of galls, coarsely powdered, with double the weight of water. The distilled liquor, as M. Deyeux observed, was a little milky, aromatic, and on standing deposited a little flocculent sediment. I changed the receiver, when about two-thirds of the liquor had come over, and I continued the distillation till it became coloured.

The first product was acid; reddened tincture of litmus; and had no action on lime or barytes water, nitrate of mercury, acetate of lead, sulphate of iron, or glue.

The second product was turbid, coloured, a little empyreumatic; its acidity was more marked; and it precipitated the metallic solutions above mentioned, but did not act on glue.

Each of these acid liquors was saturated with potash. The first yielded a foliated salt, which, on the addition of sulphuric acid, gave out a smell of acetic acid. Part of this salt was dissolved in distilled water: the excess of its base was accurately saturated by nitric acid, and nitrate of mercury at a minimum was added to the solution; when a precipitate was formed which had all the characters of acetate of

of mercury. To convince myself still further of the presence of acetic acid, I treated the neutral acetate of potash in the same manner, and it afforded me the same results.

The second product was saturated with potash in the same manner. The liquor became very brown; a slight pellicle formed on the surface, which increased during the evaporation: the saline matter was highly coloured and empyreumatic. Being subjected to the same trials as the preceding, similar appearances were observed.

These experiments leave no doubt of the presence of acetic acid in galls: they prove that it may be obtained by distillation with water, and that caloric, when it acts more directly on this acid, facilitates its combination with a small quantity of empyreumatic oil, and perhaps with a little tannin, the presence of which is not demonstrable by glue: but as this liquor acts on sulphate of iron in the same manner as the sublimed acid, we must presume that there is a kind of analogy in their composition; admitting, however, this difference, that the sublimed acid contains no empyreumatic oil, but a particular aromatic volatile oil.

This oil may be detected by dissolving the acid in very pure sulphuric ether, and adding a little water, when a few drops of oil will be seen floating on the surface, which disappear on shaking the mixture.

If a concentrated solution of caustic potash be employed instead of water, a white milky substance is separated, which requires a large proportion of water to dissolve it, but the liquor still remains turbid.

This ethereal tincture yields a fine blue colour with sulphate of iron.

Evaporated in the open air it leaves a shining substance, very acid, separating in scales, and having the appearance of a varnish.

The same phænomena takes place if galls be digested in ether; but the substance contains tannin in addition.

Examination of some Earthy and Alkaline Gallates.

Though it appears to be demonstrated that acetic acid exists ready formed in galls, we cannot too much multiply proofs

proofs in confirmation of its presence; and to demonstrate that this acid, combined with other substances, constitutes the gallic acid.

With this view I formed gallates of lime, barytes, potash, and soda. These neutral combinations afforded a violet red colour with a solution of sulphate of iron, and scarcely precipitated glue, while the acid employed had the property of forming with it a copious precipitate. On these salts, dried, I poured some very weak sulphuric acid; I distilled them with a gentle heat, and I always obtained acetic acid.

The retorts contained a very deep brown matter. I crystallized the salts that were perceptible of it, and obtained sulphates.

The supernatant mother-water had the property of slightly browning the solution of sulphate of iron; but this appearance does not prove the presence of gallic acid, for the black colour of the mother-water was sufficient to give it this hue.

If one of the gallates, that of soda for instance, be treated with charcoal, the tannin will be entirely destroyed, so that the solution will no longer precipitate glue; and after repeated boiling with fresh portions of charcoal, it will no longer act on sulphate of iron.

The liquor being afterward evaporated to dryness, and distilled with very weak sulphuric acid, we still obtain acetic acid.

I shall not insist any further on the possibility of obtaining acetic acid by decomposing gallic acid. I might mention the experiments which would tend to support the preceding, but entering too minutely into these particulars would add nothing to the facts I have already adduced.

I shall conclude with an experiment which appears to me important. The object was, to establish the nature of the elastic fluids resulting from the complete decomposition of the gallic acid by heat. M. Deyeux has announced that he obtained only oxygen gas and carbon. M. Berthollet, who repeated the experiment, says that he had no oxygen gas, but constantly carbonic acid.

These results, of which no other vegetable acid furnishes an example, could not avoid exciting the attention of chemists.

mists. In fact, it is difficult not to admit hydrogen in the composition of gallic acid; and M. Fourcroy has expressed his doubts on this subject in his System of Chemical Knowledge, but the question is not yet decided by experiment.

In consequence, I heated gallic acid in a retort. The fire was gradually raised till the retort was red-hot. During this action of the fire I obtained several jars full of elastic fluid. The first contained only atmospheric air, the others carbonic acid gas: at least, the gas had all the characters of this acid; but the phænomena that occurred during the decomposition of the gallic acid led me to suspect, that, if any hydrogen gas had been evolved, it could exist only in a very small quantity. I was not satisfied, therefore, with the trial by lime water, and the extinction of a taper in the gas. Having perceived that hydrogen gas mixed with a great deal of carbonic acid gas cannot be burnt, because this acid acts too promptly on the flame of the taper, I passed a little caustic potash into the last jar of gas; agitated it, in order to absorb the carbonic acid gas; and then immersed a taper in the residual gas, which burnt with flame, and thus afforded me a proof of the presence of carbonated hydrogen gas.

The gallic acid, then, like other vegetable acids, is composed of oxygen, hydrogen, and carbon. If but a small quantity of hydrogen can be obtained, it is because water is formed during the decomposition of the acid, so that the hydrogen passes over only when very little oxygen remains to act on the carbon.

I have attempted to show that the gallic acid is a compound. Its formation by Scheele's process appears to me to favour this opinion. In fact, if the quantity of acid extracted from the aqueous infusion, exposed to the air, be compared with that afforded by sublimation, I conceive it is not difficult to account for the increase. There can be no doubt that acetic acid is formed in the liquor, which, acting on a portion of tannin and extractive matter, constitutes the gallic acid of Scheele: but this combination is rendered more intimate, and somewhat different, by the action of caloric; of which we have a proof when the acid is obtained by sublimation, for not only is the tannin decomposed, but the

acid remains combined with a volatile oil which is formed. Perhaps this acid contains a small portion of tannin in very intimate combination, whence, no doubt, arises its property of giving a momentary blue with sulphate of iron, though its presence cannot be demonstrated. This acid, then, must have different properties from that of Scheele; and if it were possible to assimilate it to other vegetable acids, the benzoic is that to which it would have the greatest analogy. May it therefore be considered as a modification of the gallic acid? I think not. It is the same with other vegetable acids; and it is probable that there exists no modification of them. The acetous appears to be the sole vegetable acid; it dissolves and retains in various proportions a number of the immediate products of vegetables, and in the processes to which we subject vegetable substances, we facilitate its combination in a more intimate manner, and frequently even augment the quantity of this acid. Already several chemists have admitted the possibility of the acetic acid's dissolving and remaining combined with fixed and empyreumatic oils, and animal matters: they have even gone so far as to imitate acids of this sort. The formic, pyrolignic, tartarous, and mucous, have been classed by Messrs. Fourcroy and Vauquelin among the compound acids; it is the same with the lactic acid, the composition of which was pointed out at the same time by those chemists, M. Thenard, and myself: lastly, we have proof too, according to M. Thenard, of the existence of this acid in urine and sweat, as well as in the sebacic and zoonic acids. I might further add to these observations (if we were not persuaded that the acetic acid is found every where) that it exists in vegetable as in animal matters, where it is almost always in a state of combination; and that an equilibrium in the proportions being once established, it gives rise to compounds hitherto unalterable, and the affinity of which cannot be destroyed but by reducing them to their primary elements—oxygen, hydrogen, carbon, and nitrogen.

From the facts announced in this memoir it follows:

1st, That the gallic acids of Scheele and of Richter differ essentially from that obtained by sublimation; and that the crystallized

crystallized is preferable as a re-agent, on account of the constant uniformity of the colour it gives with iron.

2dly, That this acid appears to be composed of acetic acid, tannin, and extractive matter; and that it cannot be completely freed from tannin by crystallization.

3dly, That the acid obtained by sublimation contains no tannin, at least none that can be ascertained by acting on glue; and that it cannot, on any occasion, supply the place of the crystallized acid.

4thly, That the sublimed acid appears likewise to be composed of acetic acid united with a peculiar aromatic volatile oil.

5thly, That by means of water poured into the etherized tincture of galls, or ether containing the sublimed acid, an oily matter is separated.

6thly, That there is no process known for purifying Scheele's acid completely; that is to say, we cannot take from it the whole of its tannin, without reducing it to the state of acetic acid; which proves that the portion of tannin it retains is necessary to constitute gallic acid, and that to this are owing its excellent properties in the art of dyeing.

7thly, That the red oxide of mercury, and oxide of tin, as well as carbon, decompose this acid.

8thly, That by distilling galls with water acetic acid may be obtained; and that it is by the assistance of caloric acting more immediately on galls, that a more intimate union between the acid and the tannin is effected.

9thly, That the earthy and alkaline gallates likewise afford acetic acid by their decomposition.

10thly, and finally, That gallic acid, like the other vegetable acids, is composed of oxygen, hydrogen, and carbon.

If these results be accurate, we may conceive it possible to accomplish its synthesis. Some trials that I have already made give me the hope of succeeding in it. I shall do myself the honour of imparting the further results of my inquiry to the class, if they should be worthy its notice.

VII. *Note upon a fulminating Combination of Silver, of a white Colour and a crystalline Appearance.* By M. DESCOSTILS *.

THERE is sold at Paris, as an object of amusement, a detonating powder inclosed in slips of cards cut lengthways. This powder is placed at one end of this envelope, and the other end is made smaller in order to be more easily distinguished. If this last extremity is held with one hand, and the other end is put over the flame of a candle, a detonation speedily takes place with a sharp noise and a violet-coloured flame; the card is torn to pieces and scorched, and the part which the composition touched is covered with a slight metallic coating of a grayish white.

Having been consulted upon the nature of this substance, which is sent ready prepared to Paris, I was convinced, after various experiments, which it is needless to detail, that it is a combination of oxide of silver, ammonia, and a vegetable substance; a combination analogous, as we find, to that which constitutes the fulminating mercury of Mr. Howard.

We may obtain this combination, which I shall call *detonating silver* to distinguish it from the *fulminating silver* of M. Berthollet, by dissolving silver in pure nitric acid, and by pouring into the solution, while it is effecting, a sufficient quantity of rectified alcohol; or by pouring the alcohol into a nitric solution of silver, with a considerable excess of acid.

In the first case we must slightly warm the nitric acid in which the silver has been put, until the solution begins to take place; *i. e.* until the first bubbles begin to be perceived. We must then remove it from the fire and immediately add a sufficiency of alcohol, so that no nitrous vapours may be liberated. The mixture of the two liquors takes place with a disengagement of heat; the effervescence immediately recommences without disengagement of nitrous gas; it gradually increases, and there is liberated at the same time a strong

* From *Annales de Chimie*, tom. lxii. p. 199.

smell

smell of nitrous ether. The liquor soon becomes turbid, and we see deposited a white, crystalline, and opaque powder, which must be separated, when it ceases to fall down, and washed several times with small quantities of water.

When we employ the solution of silver ready made and strongly acid, we must heat it slightly and afterwards add the alcohol; the heat produced by the mixture, which is performed gradually, soon produces a considerable ebullition, and the powder is suddenly deposited *.

This powder has the following properties:

It is white and crystalline, but this last appearance is variable with respect to the volume and the lustre of the crystals.

It changes a little in the light.

It inflames with a sharp detonation by heat, agitation, or long continued friction. Simple pressure, provided it be not very strong, produces no change.

It detonates upon being struck by the electrical spark.

It is slightly soluble in water. It has an extremely strong metallic taste.

Concentrated sulphuric acid determines its inflammation, and the acid itself is driven to a great distance; dilute sulphuric acid seems to decompose it slowly.

Weak or concentrated muriatic acid decomposes it instantly by forming muriate of silver. The quantity of muriate obtained indicates about 71 per cent. of metallic silver in the detonating silver; at first there is liberated a very decided smell of prussic acid, but I could not collect sensible traces of it.

The nitric acid decomposes it with the assistance of ebullition, and we obtain nothing but nitrate of silver and nitrate of ammonia, if it be long enough continued.

It is decomposed by means of sulphurized hydrogen; the ammonia and the vegetable matter remain in the liquor.

Caustic potash decomposes it; black oxide of silver is separated, and ammonia is disengaged.

* It is almost needless to observe that the mixture of alcohol and warm nitric acid is subject to many accidents, and we must consequently operate upon very small quantities.

It is dissolved in ammonia; but by a slow evaporation it is separated from it with its proper colour and other properties, and particularly that of detonating by means of heat, and not by simple contact.

Finally, its property of most importance to consider is, the action it has upon the animal œconomy. M. Pajot-la-Forêt, who has made a great number of experiments upon this subject, is convinced that very small doses are sufficient to kill the strongest animals: when tried upon some cats, all of them expired in the most horrible convulsions. It is, in short, without exception, one of the most violent poisons with which the metallic combinations present us.

VIII. *Memoirs of* Erasmus Darwin, *M. D.*

Seldom do we find so great and diversified talents as were united in the late Dr. Darwin. He shines forth as a meteor, even in an age conspicuous for extraordinary talents usefully employed for the benefit and instruction of mankind. We shall pass over his education at Chesterfield school, where the master, the Rev. Mr. Burrow, noticed strong signs, even then, of a rising genius; and his being afterwards sent by his father Robert Darwin, Esq. of Elston, near Newark, to King's College, Cambridge, where he distinguished himself by his attention to his studies. It is a melancholy fact, that our English universities are incompetent to form the physician; but they lay the foundation of general knowledge, which in the end may conduce to the formation of the perfect physician. With a store of classical and mathematical knowledge, young Darwin went from Cambridge to Edinburgh, then in its zenith of splendour, and, at the proper age to feel the force of instruction, imbibed all the knowledge that proceeded from that clear fountain of vast medical erudition. Desirous of still deeper knowledge, from Edinburgh he went to London to perfect himself in anatomy under the celebrated Dr. Hunter, which science, it must be confessed, from the easy acquisition of subjects for dissection, is even better taught in that metropolis than in the Scotch

Scotch university. Thus every thing combined to render him an adept in his profession, and it might have been expected that nothing could have retarded his establishment in any part of England: but unfortunately for professions of every kind, it requires time before superiority is acknowledged, and he struggled in vain to obtain any practice in Nottingham, which obliged him to attempt to settle at Lichfield in the year 1756, where he believed he had less formidable obstacles to encounter. Dr. Wilkes possessed at that time the entire confidence and all the practice of that quarter, and little expectation could be formed of Dr. Darwin's superior talents having opportunity of getting into play, when a fortunate trial of his skill and knowledge occurred, which could not fail of settling him in the estimation of the whole country. A young gentleman of family and considerable fortune, Mr. Inge, was seized with a putrid fever. Dr. Wilkes very unguardedly, or from the candour inherent in cultivated minds, which scorns falsehood or evasion, pronounced the case as lost. In the distraction of despair the mother requested a consultation, but the old physician declined the meeting; and the mother, a woman of superior sense, had rather trust a young physician, who might have a knowledge according to the advancement of science, than an old man who positively pronounced the extinction, in his mind, of every ray of hope. Whether Dr. Darwin had a superior practice to Dr. Wilkes or not, the public judged of the event, and from that occurrence he might be said to be partly settled at Lichfield.

As unmarried physicians have still much to cope with, nothing seemed now wanting but the changing his condition of life. The young physician had very general invitations to families, nor would any father have refused his daughter, but he would only yield his heart to one worthy indeed of such a man. A young lady of very slender fortune, of infinite modesty and worth, of delicate sentiment, and replete with grace and accomplishments, caught the admiring eye of one who could discern retired excellency; and, to the surprise of many, he yielded up to Miss Howard his heart

and hand. The dying and recorded conversation * of Mrs. Darwin exhibits an affecting account of his first thirteen years residence at Lichfield, and his character as a husband. "Do not weep for my impending fate," said this amiable creature in the last stage of a decline, and with a smile of unaffected resignation. "In the short term of my life a great deal of happiness has been comprised. The maladies of my frame were peculiar; the pains in my head and stomach, which no medicine could eradicate, were spasmodic and violent, and required stronger measures to render them supportable while they lasted, than my constitution could sustain without injury. The periods of exemption from those pains were frequently of several days duration, and in my intermissions I felt no indication of malady. Pain taught me the value of ease, and I enjoyed it with a glow of spirit seldom, perhaps, felt by the habitually healthy. While Dr. Darwin combated and assuaged my disease from time to time, his indulgence to all my wishes, his active desire to see me amused and happy, proved incessant. His house, as you know, has ever been the resort of people of science and merit. If, from my husband's great and extensive practice, I had much less of his society than I wished, yet the conversation of his friends, and of my own, was ever ready to enliven the hours of his absence. As occasional malady made me doubly enjoy health, so did those frequent absences give a zest, even to delight, when I could be indulged with his company. My three boys have ever been docile and affectionate. Children as they are, I could trust them with important secrets, so sacred do they hold every promise they make. They scorn deceit, and falsehood of every sort, and have less selfishness than generally belongs to childhood. Married to any other man, I do not suppose I could have lived a third part of those years which I have passed with Dr. Darwin; he has prolonged my days, and he has blessed them."

The fruits of this marriage were three sons; and one of these inheriting from their father an impediment of speech,

* By Miss Anna Seward, in the Life of Dr. Darwin.

the

he learned doctor attempted the following expedient as the cure. He reasoned thus: that he had acquired this defect probably from that strong propensity which all children have to imitate those with whom they associate. With that wisdom which marked the doctor's observations on the habits of life, and with that decision of conduct which always instantly followed the conviction of his mind, he sent his eldest boy, Charles, to France, in the belief that in the pronunciation of a foreign language hesitation would be less likely to recur than in speaking his native language; nor was he disappointed in the event: the habit was thus broken, and two years afterwards, on his return, he was able to speak his mother tongue with ease and fluency.

Lichfield seemed admirably suited to such a genius as was Dr. Darwin's. It appeared to be the favourite spot of the Muses, and of men of science; and we would recommend our readers who would wish for information respecting the literati* settled at Lichfield, to consult Miss Seward's "Memoirs of Dr. Darwin."

During his residence at Lichfield Dr. Darwin met with an accident which had nearly cost him his life. Being obligated to travel much, he wished, if possible, to obviate the inconvenience of quartering, so distressing to horses; and for this purpose, having a mind above ridicule, he constructed a very singular carriage. It was a platform, with a seat fixed upon a very high pair of wheels, and supported in the front, upon the back of the horse, by means of a kind of proboscis, which, forming an arch, reached over the hind quarters of the horse, and passed through a ring placed on an upright piece of iron, which worked in a socket fixed in the saddle. The horse could thus move from one side of the road to the other, quartering, as it is called, at the will of the driver, whose constant attention was necessarily employed to regulate a piece of machinery contrived, but *not quite* adapted, for that purpose. From this whimsical carriage the doctor was several times thrown, and the last time he used it, had the misfortune, from a similar accident,

* Philosophers—Edgeworth, Watt, Boulton; poets—Day, Sir Brook Boothby, Anna Seward, &c.

to break the patella of his right knee, which caused, as it always must cause, an incurable weakness in the fractured part, and a lameness, not very discernible, indeed, when walking on even ground.

One may here mention, that he was also conspicuous by having a horse always to follow his carriage like a dog, properly saddled, and, where the roads were very bad, he would mount on horseback, without boots or spurs, often in coloured stockings, and thus visit his patient, and return back to his carriage which was waiting for him.

Having destined two of his sons for physic, he took himself uncommon pains with their education; and his eldest and darling son, Charles, was sent to Edinburgh as a prodigy of knowledge. He soon acquired great literary fame from his discovery of the distinction of pus and matter, and the retrograde motion of the absorbents, explanatory of several diseases and circumstances in the animal œconomy, when Dr. Darwin received the melancholy tidings of his rapid dissolution, though but a few days before in the bloom of health and life, from the scratch of the dissecting-knife in the too eager dissection of a dead and putrid body.

His hopes were now concentred on Robert, whom he likewise sent to Edinburgh, and who early signalized himself by a paper in the Philosophical Transactions "On the Spectra of Colours," and whom he settled at Shrewsbury in the bloom of scarcely ripened youth, and who even then acquired the confidence of all, and continues still to possess a very extensive practice and universal esteem.

His third son, Erasmus, he bred to the law, who, imagining that his affairs were perplexed (but which actually was not the case when his debts were collected), became gloomy, and, in a fit of melancholy and despair, plunged into that "bourne whence no traveller returns."

Dr. Darwin is severely reprobated by some as not having publicly exhibited those outward marks of sorrow for the loss of his two sons which might have been expected: but the reader will remember that his mind was of no ordinary stamp, and he probably concealed from the world the real sufferings of a father; for that he was a man of keen sen-

sibility

sibility his writings and whole life declare, and he thus depicts himself his true character:

> And now, e'en I, whose verse reluctant sings
> The changeful state of sublunary things,
> Bend o'er mortality with silent sighs,
> And wipe the *secret* tear-drops from my eyes,
> Hear through the night one universal groan,
> And mourn unseen for evils not my own;
> With restless limbs and throbbing heart complain,
> Stretch'd on the rack of sentimental pain!

Partly with a view for the instruction of his sons, and of the world at large, he commenced at Lichfield his Zoonomia, or Laws of Organic Life.

He was much attached to botany, and the wild scenery of nature. Living in a romantic country, and viewing it with a poet's eye, and regretting that there were but few votaries to it, probably owing to the science being concealed in a learned garb, he began, with Sir Brook Boothby and Dr. Jackson, a Translation of the Genera and Species Plantarum of Linnæus, which goes by the appellation of being done by the Lichfield Botanical Society; although it consisted only of those three persons, no others being found willing to enter into that body. That Dr. Darwin was still proud of this establishment is proved by his ordering of Rivington, Dr. Thornton's "New Illustration of the Sexual System, including the Temple of Flora*," in the name and for the Lichfield Botanical Society, although the doctor was now settled at Derby.

If there was any thing yet wanting to establish Dr. Darwin's medical reputation at Lichfield, it was accomplished by the recovery of the countess of Northesk. This lady had been under several eminent physicians of London and Bath, and, finding their endeavours ineffectual, the countess was advised to try her native air, and had arrived as far as Lichfield, on her journey home. There she learnt the great re-

* Speaking of this work in his *Phytologia*, Dr. Darwin says, "I beg leave to recommend to the public the coloured picturesque botanical plates just published by Dr. Thornton, which I suppose has *no equal*."

putation

putation of the doctor, and the many wonderful cures he had performed, and she resolved to consult him. The doctor heard the case with patient attention, and with honest integrity told her ladyship, "that if she would confide in his judgment he had full hopes of her recovery." One injunction he made, that the countess would remain at Lichfield. He condemned the system her ladyship had followed, of nutritious food, rich jellies, and wine, and a quantity of medicine every three or four hours, with forcible exertions of body and mind, and substituted exactly a reverse system; and in three weeks the countess was completely restored, and able to resume her journey, not for health, but to enjoy the society of her elegant circle of friends, who admired greatly the sagacity of that physician who had saved her life.

One may here remark that Dr. Darwin was ever unfriendly to the system of too much excitement, and so decidedly inimical to the use of wine and strong spirits, that he instituted a spirit of sobriety in the inhabitants of Lichfield which was almost incredible. His cautions he sometimes gave even in a poetic dress.

Address of a Water-Nymph at Belmont to the Owner of that Place.

O friend to peace and virtue, ever flows
For thee my silent and unsullied stream,
Pure and untainted as thy blameless life!
Let no gay converse lead thy steps astray
To mix my chaste wave with immodest wine,
Nor with the poisonous cup, which Chemia's hand
Deals, fell enchantress, to the sons of Folly!
So shall young Health thy daily walks attend,
Weave for thy hoary brow the vernal flower
Of cheerfulness, and with his nervous arm
Arrest th' inexorable scythe of Time.

His sentiments respecting fermented liquor are very singular, and worthy of attention. In the note to his Verses on the Vine, where he complains that by chemistry fermentation converts sugar into spirit, and food into poison; he adds, that from this process more than half of our chronical

nical diseases arise. The antient story of Prometheus, who concealed in his bosom the fire he had stolen, and afterwards had a vulture perpetually gnawing his side, affords so apt an allegory for the effects of drinking spirituous liquors, that one is induced to think the art of distillation had been known in times of great antiquity: for the swallowing drams cannot be better represented in hieroglyphic language than by taking fire into one's bosom; and certain it is, that the general effect of drinking spirituous or fermented liquors is an inflamed scirrhous, or paralytic liver, with its various critical or consequential diseases, as leprous eruptions on the face, gout, dropsy, epilepsy, insanity. It is remarkable that *all the diseases* from drinking spirituous or fermented liquors are liable to become *hereditary* even to the *third* generation, gradually increasing, if the *cause* be continued, *till the family becomes extinct*.—Such are Dr. Darwin's sentiments.

He now was sought after even from a distance, and colonel and Mrs. Pole, of Radburn, Derbyshire, in 1778, came purposely to Lichfield for the recovery of their children, who were suspected of being in a decline after the hooping-cough.

Mrs. Pole was then in the full bloom of her youth and beauty. Agreeable features; the glow of health; a fascinating smile; a fine form, tall and gracefully playful sprightliness of manners; a benevolent heart and maternal affection, in all its unwearied cares and touching tenderness, contributed to inspire Dr. Darwin's admiration, and to secure his esteem. Soon after she left Lichfield with her renovated little ones, their restorer sent to his friend Mr. Bolton, of Birmingham, the following directions for making a tea-vase, designed as a present from the doctor to Mrs. Pole.

Friend Bolton, take these ingots fine
From rich Potosi's sparkling mine;
With your nice art a tea-vase mould,
Your art, more valu'd than the gold.
With orient pearl, in letters white,
Around it, "To the Fairest," write;
And, where proud Radburn's turrets rise,
To bright Eliza send the prize.

I'll

I'll have no bending serpents kiss
The foaming wave, and seem to hiss;
No sprawling dragons gape with ire,
And snort out steam, and vomit fire;
No Naiads weep; no sphinxes stare;
No tail-hung dolphins swim in air.
Let leaves of myrtle round the rim,
With rose-buds twisting, shade the brim;
Each side let woodbine stalks descend,
And form the branches as they bend;
While on the foot a Cupid stands
And twines the wreath with both his hands.

Perch'd on the rising lid above,
O place a lovelorn turtle dove,
With hanging wing, and ruffled plume,
With gasping beak, and eye of gloom.

Last, let the swelling bosses shine
With silver, white, and burnish'd fine,
Bright as the fount, whose banks beside
Narcissus gaz'd, and lov'd, and died,

Vase, when Eliza deigns to pour,
With snowy hand, thy boiling shower;
And sweetly talks, and smiles, and sips
The fragrant steam with ruby lips,
More charms thy polish'd orb shall shew
Than Titian's glowing pencil drew;
More than *his* chisel soft unfurl'd,
Whose heav'n-wrought statue charms the world.

The reader must call to mind that Dr. Darwin was a gentleman of the highest sense of honour, and Mrs. Pole a lady of the greatest reserve, yet most fascinating manners; and that their admiration was mutual, and their love platonic. The poet thus paints the antiquated colonel, her husband:

Fly, gentle steeds!—o'er yon unfriendly towers
Malignant stars with baleful influence reign;
Cold Beauty's frown infects the cheerless hours,
And Avarice dwells in Love's polluted fane!

Dim

Dim, distant towers! whose ample roof protects
All that my beating bosom holds so dear,
Far shining lake! whose silver wave reflects
Of Nature's fairest forms, the form most fair;

Groves, where at noon the sleeping beauty lies;
Lawns, where at eve her graceful footsteps rove;
For ye full oft have heard my secret sighs,
And caught, unseen, the tear of hopeless love;

Farewell! a long farewell!—your shades among
No more these eyes shall drink Eliza's charms;
No more these ears the music of her tongue!
O! doom'd for ever to another's arms!

Fly, gentle steeds!—my bleeding heart convey
Where brighter scenes and milder planets shine;
Where Joy's white pinion glitters in the ray,
And Love sits smiling on his crystal shrine!

These lines were composed and never sent, but locked up, with others, in a bureau, and afterwards, as will be seen, presented to the fair lady.

Near Lichfield Dr. Darwin purchased a beautiful sylvan spot, which he cultivated as his garden, and which was soon celebrated by Miss Anna Seward, of Lichfield, a sweet poet, and the lines presented to Dr. Darwin. He said "that these should be the exordium of a poem which should be called The Botanic Garden, or Loves of the Plants;" and advised this lady to undertake such a poem. This she declined, but pressed it on the doctor, who had never yet composed a whole poem, but only fugitive pieces, such as we have given a specimen of; and he immediately from that instant commenced the execution of The Botanic Garden, which astonished an admiring world, and procured for the doctor the appellation of the English Lucretius.

Whilst busied on this poem, the antiquated colonel Pole died. The widow, then in the zenith of her beauty, and still alive to the world, had scarce laid aside her weeds when many suitors came to solicit her hand and fortune. The doctor was turned of fifty, rather corpulent, somewhat lame, had

had a dreadful stammer when eager in utterance, and rather harshly featured; yet sense beamed from his eye, and his eye-brow was expressive, and he had restored her three children, who were amply provided for. He likewise came a-courting, and recounted those verses he had formerly made on her charms. She was not long inflexible, although she had ample choice amongst gentlemen fox-hunters, dashing young officers, bowing parsons, and a long train of other gentry —for the kind, the benevolent, the heaven-poetic-inspired Dr. Darwin had the preference; but whether fearful that an unjust suspicion would exist amongst the prudes and gossips of Lichfield from this preference, that they might not have mind enough to comprehend the true reason of her choice in consenting to give him her hand, she stipulated he would immediately remove to Derby.

[To be continued.]

IX. *Description of a circular Mother-of-Pearl Micrometer.* By David Brewster, *A. M.*

To Mr. Tilloch.

Sir,

In the Philosophical Transactions for 1791, Mr. Tiberius Cavallo has given an account of an ingenious and simple micrometer, invented by himself, and excellently fitted for measuring small angles with accuracy and expedition. It consists of a slip of mother-of-pearl minutely subdivided, and stretched across the diaphragm that is placed in the anterior focus of the fourth eye-glass of an achromatic telescope. The angle subtended by any number of its divisions is then ascertained by experiment, and therefore the value of any other number can either be found by simple proportion, or from a table computed for the purpose. The method of forming this table, and the various purposes to which this micrometer is applicable, have been given at great length by Mr. Cavallo in his paper in the Philosophical Transactions, and in a separate pamphlet descriptive of the instrument.

In

In the winter of 1805, when I was employed in delineating the surface of the moon, I wished to measure the diameter of the lunar spots by applying Mr. Cavallo's micrometer to a thirty-inch achromatic telescope made by Berge. But as the eye-piece was moved by a rack and pinion, and consequently could not turn round its axis, the micrometer must have remained stationary, and could only measure angles in one direction. This difficulty, indeed, might have been surmounted by a mechanical contrivance for turning the diaphragm about its centre, or more simply by giving a motion of rotation to the tube which contains the third and fourth eye-glasses. Such a change in the eye-piece, however, was both inconvenient and difficult to be made. Mr. Cavallo's micrometer, therefore, has this great disadvantage, that it cannot be used in reflecting telescopes, or in any achromatic telescope where the adjustment of the eye-piece is effected by rack-work, unless the structure of these instruments is altered for the purpose. Another disadvantage of this micrometer arises from the slip of mother-of-pearl passing through the centre of the field. The picture in the focus of the eye-glass is broken into two parts, and the view is rendered still more unpleasant by the inequality of the segments into which the field is divided. In addition to these disadvantages, the different divisions of the micrometer are at unequal distances from the eye-glass which views them, and therefore can neither appear equally distinct nor subtend equal angles at the eye.

Finding that Mr. Cavallo's instrument laboured under these imperfections, I thought of a circular mother-of-pearl micrometer which is free from them all, and has likewise the advantage of a kind of diagonal scale, increasing in accuracy with the angle to be measured. This micrometer, which I got executed by Miller and Adie, optical instrument makers in Edinburgh, and which I have often used, both in determining small angles in the heavens and such as are subtended by terrestrial objects, is represented in fig. 1, which exhibits its appearances in the focus of the fourth eye glass. The black ring, which forms part of the figure,

is the diaphragm, and the remaining part is a ring of mother-of-pearl, having its interior circumference divided into 360 equal parts. The mother-of-pearl ring, which appears connected with the diaphragm, is completely separate from it, and is fixed at the end of a brass tube which is made to move between the third eye-glass and the diaphragm, so that the divided circumference may be placed exactly in the focus of the glass next the eye. When the micrometer is thus fitted into the telescope, the angle subtended by the whole field of view, or by the diameter of the innermost circle of the micrometer, must be determined either by measuring a base or by the passage of an equatorial star, and the angles subtended by any number of divisions or degrees will be found by a table constructed in the following manner.

Let A*mpn*B, fig. 2. be the interior circumference of the micrometer scale, and let *mn* be the object to be measured. Bisect the arch *mn* in *p*, and draw C*m*, C*p*, C*n*. The line C*p* will be at right angles to *mn*, and therefore *mn* will be twice the sine of half the arch *mn*. Consequently, AB : *mn* = rad. sine of $\frac{1}{2}mpn$; therefore $mn \times R = \text{sin. } \frac{1}{2}mpn \times AB$, and $mpn = \frac{\text{sin. } \frac{1}{2}mpn \times AB}{R} = \frac{\text{sin. } \frac{1}{2}mpn}{R} \times AB$; a formula by which the angle subtended by the chord of any number of degrees may be easily found. The first part of the formula, viz. $\frac{\text{sin. } \frac{1}{2}mpn}{R}$ is constant, while AB varies with the size of the micrometer and with the magnifying power which is applied. We have therefore computed the following table, containing the value of the constant part of the formula for every degree or division of the scale.

Degrees.	Constant Part of the Formula.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.	Degrees.	Constant Part.
1	·0087	19	·1650	37	·3173	55	·4617	73	·5948	91	·7133	109	·8141	127	·8949	145	·9537	163	98,0		
2	·0174	20	·1736	38	·3256	56	·4695	74	·6018	92	·7193	110	·8192	128	·8988	146	·9563	164	·9903		
3	·0262	21	·1822	39	·3338	57	·4771	75	·6088	93	·7254	111	·8241	129	·9026	147	·9588	165	·9914		
4	·0349	22	·1908	40	·3420	58	·4848	76	·6157	94	·7314	112	·8290	130	·9063	148	·9613	166	·9925		
5	·0436	23	·1994	41	·3502	59	·4924	77	·6225	95	·7373	113	·8339	131	·9100	149	·9636	167	·9936		
6	·0523	24	·2079	42	·3584	60	·5000	78	·6293	96	·7431	114	·8387	132	·9135	150	·9659	168	·9945		
7	·0610	25	·2164	43	·3665	61	·5075	79	·6361	97	·7490	115	·8434	133	·9171	151	·9691	169	·9954		
8	·0698	26	·2250	44	·3746	62	·5150	80	·6428	98	·7547	116	·8480	134	·9205	152	·9708	170	·9962		
9	·0785	27	·2334	45	·3827	63	·5225	81	·6494	99	·7604	117	·8526	135	·9239	153	·9724	171	·9969		
10	·0872	28	·2419	46	·3907	64	·5299	82	·6561	100	·7660	118	·8572	136	9272	154	·9744	172	·9976		
11	·0958	29	·2504	47	·3987	65	·5373	83	·6626	101	·7716	119	·8616	137	·9304	155	·9763	173	·9981		
12	·1045	30	·2588	48	·4067	66	·5446	84	·6691	102	·7771	120	·8660	138	·9336	156	·9781	174	·9986		
13	·1132	31	·2672	49	·4147	67	·5519	85	·6756	103	·7826	121	·8704	139	·9367	157	·9799	175	·9990		
14	·1219	32	·2756	50	·4226	68	·5592	86	·6820	104	·7880	122	·8746	140	·9397	158	9816	176	·9994		
15	·1305	33	·2840	51	·4305	69	·5661	87	·6884	105	·7934	123	·8788	141	·9426	159	·9833	177	·9996		
16	·1392	34	·2923	52	·4384	70	·5735	88	·6947	106	·7986	124	·8829	142	·9455	160	·9848	178	·9998		
17	·1478	35	·3007	53	·4462	71	·5807	89	·7009	107	·8039	125	·8870	143	·9483	161	·9863	179	1·0000		
18	·1561	36	·3090	54	·4540	72	·5878	90	·7071	108	·8090	126	·8910	144	·9511	162	·9877	180	1·0000		

In order to find the angle subtended by any number of degrees, we have only to multiply the constant part of the formula corresponding to that number in the table by AB, or the angle subtended by the whole field. Thus if AB is 30 minutes, as it happens to be in the micrometer which I have constructed, the angle subtended by 1 degree of the scale will be $30' \times \cdot009 = 16\frac{2}{3}$ seconds, and the angle subtended by 40 degrees will be $30' \times \cdot342 = 10' 15{\cdot}6''$; and by making the calculation it will be found that as the angle to be measured increases, the accuracy of the scale also increases; for when the arch is only 1 or 2 degrees, a variation of 1 degree produces a variation of about 16 seconds in the angle; whereas when the arch is between 170 and 180, the variation of a degree does not produce a change much more than one second in the angle. This is a most important advantage in the circular scale, as in Cavallo's micrometer a limit is necessarily put to the size of the divisions.

It is obvious, from an inspection of fig. 1, that there is no occasion for turning the circular micrometer round its axis, because the divided circumference lies in every possible direction. In fig. 2., for example, if the object has the direction *ab* it will be measured by the arch *aob*, and if it lies in the line *cd* it will be measured by the arch *crd*.

In the circular micrometer which I have been in the habit of using, AB, or the diameter of the field of view, is exactly half an inch, the diameter of the brass tube in which it is fixed is one inch, the length of the tube half an inch, and the degrees of the divided circumference $\frac{1}{230}$th of an inch.

I am, sir,

Your obedient humble servant,

DAVID BREWSTER.

Edinburgh,
September 1, 1807.

X. *Additional Memoir upon living and fossil Elephants.* By *M.* CUVIER.

[Continued from vol. xxviii. p. 366.]

I HAVE endeavoured to represent this progress of dentition in the figures of my Plates (III and IV) of elephants.

Plate

Plate IV. fig. 5. is a cranium of an Indian elephant cut vertically.

a, the entrance of the nostrils.

b, *b*, the enormous thickness of the sinuses which separate the two partitions of the cranium.

c, the cavity of the brain.

d, the occipital hole, and the right condylus of that name.

e, the alveolus of the tusk.

f, the cavity of the tusk opened, in order to show the space occupied by its pulpy nucleus.

In the space from *f* to *g*, a portion of the maxillary bone and all the palatine bone have been removed, in order to show the teeth and their germs in their situation throughout their whole extent.

h, is the anterior tooth, reduced almost to nothing by detrition, and by the compression as much of the subsequent teeth as of its own alveolus.

i, the tooth at full growth, the roots of which begin to be formed in *k*, and the triturating part of which, *l*, is already worn down to a tablet. The posterior laminæ, *m*, are as yet untouched.

n, the germ of the back tooth, as yet locked up in its membranous capsule, and the latter lodged in a cavity of the back jaw.

o, the nerve of the fifth pair, which gives threads to the capsules of the teeth and to their pulpy nuclei.

These two same teeth are represented more at large, Plate III. fig. 1 and 2.

Fig. 1. is the tooth when full grown; *a*, *b*, the portion of its laminæ already worn down to a tablet; *b*, *c*, the portion as yet untouched; *d*, *c*, *f*, its roots, which are sunk among the productions of the alveolus *g*, *h*, *i*.

I have removed the whole of the anterior face of the roots and of the base of the fast of the tooth, in order to show the pulpy nucleus *k*, *l*, *m*.

As the body of the tooth is almost entirely closed and filled, the small transverse walls *n*, *o*, *p*, *q*, *r*, *s*, are almost entirely shortened and compressed; but in return for this,

the pedicles *t, u, v, x*, which serve for the formation of the roots, are already much lengthened.

Fig. 2. is the germ of the back tooth, extracted with its capsule from the cavity of the back jaw.

a, b, remains of the periosteum of the alveolus.

c, d, anterior part of the external membrane of the capsule.

e, f, portion of this external membrane, detached and folded down in order to show the internal membrane *g, h, i.*

k, k, k, k, &c. transversal productions of this internal membrane, which separate the laminæ of the tooth and the gelatinous walls upon which these laminæ are formed.

I have removed the portions of the membrane which united these productions, in order to exhibit the laminæ of the tooth which they covered.

l, l, l, the body of the pulpy nucleus of the tooth.

m, m, m, m, &c. its productions, or the small transverse walls which it sends out among the productions of the capsule, and upon which are formed the laminæ of the tooth.

n, n, n, n, &c. laminæ, said to be osseous, transuded by these small walls which envelop them, and the whole of which forms the tooth. The posterior ones are much shorter, and do not envelop so completely their small walls, because the transudation begins later behind.

o, o, o, o, &c. the enamel deposited upon these laminæ by the internal face of the capsule. There is much less upon the posterior laminæ for the same reason.

In the part *d, g, h*, the cortical has already covered the enamel and soldered the laminæ together.

p, p, p, the interruptions of continuity which separate the commencements of the pedicles of the roots.

Fig. 3. is the middle part of this same germ, seen by its posterior face.

a, a, its base, seen a good deal shortened.

b, one of the last small transverse walls.

c, lamina said to be osseous, which as yet only envelops its notches.

d, a notch, the envelop of which is not as yet joined to the others.

e, e, e, e,

e, e, e, e, the enamel which begins to be deposited upon this lamina.

f, the rest of the capsule.

g, g, extremities of the transverse laminæ of the capsule.

h, h, bases of the small transverse walls of the pulpy nucleus.

i, i, i, laminæ of the tooth which envelop them.

k, k, enamel which begins to be deposited upon these laminæ.

Fig. 4. represents the last small walls of the pulpy nucleus detached from the rest, and separated from each other.

a, the laminæ in the shape of a small horn, which had begun to form upon the notches of the most anterior.

b, those which had only sprung up upon the notches of the one before the last.

c, the last of all, which has not as yet any hard envelop.

Fig. 5. a lamina of a germ of the tooth of an Indian elephant, viewed on its broad face.

a, a, its part which is soon to shoot out of the capsule and the gum, and on which we already see the cortical spread, as if by drops.

b, b, its middle part, where there is not as yet, upon the substance called osseous, any thing else than enamel, like threads of velvet.

c, c, its part of the base, or the substance called osseous, is as yet bare, without either enamel or cortical.

Fig. 6. a similar lamina of the African elephant.

a, the ridge, which gives to the section of the laminæ of this species the figure of a lozenge.

Article III.

Upon the Tusks of Elephants; the Structure, Growth, and distinguishing Characters of the Ivory, and its Diseases. Conclusion of the general Remarks upon the Teeth.

We shall not stop to refute the opinion of some among the moderns *, that the tusks of elephants are horns. This

* Ludolph. Æthiop. lib. i. cap. 10. Perrault, Description de l'Elephant de Versailles, &c.

was an old idea maintained by Pausanias *, refuted by Philostratus, and which no person adopted any longer.

On the contrary, the greatest part of the anatomists who think that teeth grow like common bones, by a kind of intus-susception, take their proofs from ivory, its diseases and its accidents.

Nevertheless, ivory is formed, like the other teeth, from successive layers being transuded by the pulpy nucleus.

I opened the alveolus and the base of a tusk in a recent carcase of an elephant; and here I saw evidently a pulpy nucleus of enormous size, and entirely deprived of all organical union with the tusk, which it had nevertheless secreted. Although the carcase was perfectly fresh, I could not see the least adherence between the tusk and the nucleus; not the least fibre, nor the smallest vessel; no cellulosity tied them together. The nucleus was in the cavity of the tusk, like a sword in its scabbard, and only adhered by itself to the bottom of its alveolus.

The tusk is therefore in its alveolus like a nail driven into a plank. Nothing retains it there except the elasticity of the parts which enclose it; we may therefore change its direction by gentle pressure. This is an experiment which succeeded with our second elephant: its tusks were brought so close together as to constrain the motion of its proboscis; we separated them by means of a bar of iron, the middle of which was in the form of a vice, and we could thus lengthen it at pleasure. Every one knows that dentists do the same thing, upon a small scale, with wires, with such teeth as have only one root.

The successive layers of which the ivory is composed leave but few traces upon the section of a fresh tusk; but here the fossil teeth assist us in better ascertaining the structure of the parts. Those tusks which have been decomposed and altered by their being under-ground, are split into conical and thin laminæ, all enveloped within each other, and thereby show what has been their origin.

* Vita Apollonii, lib. ii. cap. 13.

No

No bone whatever, properly so called, ever splits in this manner. Sloane, as I think, was the first who made this remark.

Scratches, or any scars whatever, made on the surface of a tusk, are never filled up; they disappear only in proportion as the tusk is worn down by friction.

It is true, we sometimes find balls in the heart of the ivory without seeing the hole through which they entered.

Our museum possesses an example of this, and we find several others scattered through various works *.

Some have concluded that the track pursued by the balls must have been filled up even by the juices of the tusk and by its organical force †; or, as Haller expresses it, by a kind of stalactite ‡: but it is easy to see, on the contrary, that this hole is not filled up in this manner. The whole of the ivory outside the ball is similar to the rest; that part only which immediately surrounds it is irregular: the ball must have traversed the alveolus and the base, while yet thin, of the tusk of a young elephant, and must have been lodged in the pulpy nucleus, still undeveloped: it has been afterwards seized by the layers transuded by this nucleus, and has there remained fixed.

Camper has already explained it in this way. (*Descrip. Anat. d'un Elephant*, p. 54.)

We cannot, therefore, deduce from this fact any consequence that can justify the nutrition of ivory by intus-susception.

For the same reason it proves nothing against the opinion of Duhamel upon the formation of the bones by the hardening of the successive layers of the periosteum, although Haller has drawn one of his principal arguments from this.

As to the diseases of ivory, those which belong to the alteration of its texture proceed merely from a disease in the

* *Blumenbach*, Manuel d'Anat. Comp. p. 43. *Gallandat*, Memoires de l'Acad. de Harlem, ix. 352. *Bonn*, Thes. Hovian. p. 146. *Camper*, Anat. d'un Eleph. pl. xx. figs. 11 & 12. *Haller*, Op. Min. ii. p. 554.

† *Haller*, Phys. viii. p. 312.

‡ Ibid. p. 330.

pulpy

pulpy nucleus at the period when it secreted the altered portion; and what has been called *exostosis* is always inside, and never outside. It is the effect of a secretion for the moment, too abundant at a certain point.

Specimens of diseased ivory have been often given by exhibiting the canine teeth of the morse (*trichecus rosmarus*), the texture of which is naturally grained. Daubenton himself has fallen into this error.

The diseases of the teeth are nearly in the same case as those of the ivory.

What has been called *caries*, an almost necessary consequence of the removal of the enamel, is the decomposition which the internal substance would undergo, when it would even be no longer adherent to the body if it remained exposed to the heat of the mouth, and the action of the saliva and various food; but it has no reference whatever to the caries of the bones.

The tendency to caries which the teeth of several people evince, proceeds from their substance not being of a good composition, and may be ascribed to the bad state of the pulpy nucleus when it transuded them.

It is the same with the spots and the more tender layers we observe in the thickness of some teeth. All are the effects of momentary indispositions of the pulpy nucleus.

Pains and inflammations exist in the pulpy nucleus, and not in the hard part of the tooth. It is the pulpy nucleus which is sensible to the shocks and the temperature of bodies passing through the envelop which the hard part forms around it.

It may be perhaps surprising to some that so thick and hard an envelop does not blunt all sensation; but the pulp of the nucleus of the teeth is, next to the retina and the pulp of the labyrinth of the ear, the most sensible part of the animal frame. Fishes, which have their labyrinth inclosed in the cranium, without any box or tympanum, and without small bones; in a word, without any communication opening externally, hear sounds in consequence of vibrations communicated to the cranium. The teeth, however,

ever, evince something much stronger in point of sensibility.

The exostoses of the teeth (their fungosities) do not grow upon the surface of the enamel of a sound tooth, but in the bottom of the hollows of the carious ones. These are productions of the pulpy nucleus, which have pierced the hard matter in the thin bottom of these hollows.

The continual lengthening of those teeth which have none opposite to them to retain them, agrees with all these facts; the portion once sent out of the tusk of the elephant lengthens always, but does not become thicker, and does not harden: this is because it is always pushed back by new layers, while in itself it cannot undergo any change. We know how far this lengthening proceeds in rabbits which have lost a tooth, and whose opposite tooth is no longer worn by mastication. Continuing to lengthen backward, it finally hinders the animal from eating. It was from this that Aristotle asserted that the teeth grow all our lives, while the other bones have determinate limits.

It must be added, however, that the ordinary teeth have a determined limit: this is when the entrance of their cavity is obliterated, and when their pulpy nucleus receives no more nourishment; but nature has taken care to leave the paths always open in those animals which, from wearing their teeth much, require that they should be often repaired behind: such are the rabbits with respect to their incisors, and the elephants with respect to their tusks: the root never being obliterated, its channel can never be closed.

Article IV.

Application of the Observations upon the Dentition of the Elephant to the Knowledge of Fossils.

For want of information on the subject of the formation and the manner in which teeth grow in general, describers of fossils have committed a multitude of errors; but as the circumstances relative to the teeth of the elephant are still more complicated and more difficult than those which concern the other animals, these have led people into much greater mistakes.

Formerly

Formerly a great number of authors were in possession of entire and well formed teeth of fossil elephants without knowing it.

Aldrovandus, Leibnitz, Kundman, and Beuth, were in this situation.

The inverse of this case has often taken place also, and teeth of a very different description have been exhibited for those of elephants.

Aldrovandus (*De Metall.*) describes three teeth of the hippopotamus as those of an elephant.

M. de la Metherie (Theory of the Earth, vol. v. p. 200,) says that the tooth found near Vienne, in Dauphinè, and engraved in the *Journal de Physique* for February 1773, p. 135, seems to have belonged to the elephant of Africa. We have shown that it must have belonged to a species of the grand tapir. The same author (at p. 201) asserts, "that it is now proved that the teeth from the Ohio, and those brought from Peru by Dombey, are those of an elephant which is of the same species as that of Africa."

Notwithstanding all this, the teeth from Vienne, those of Ohio, and those from Peru, do not resemble each other at all, and neither of them resemble those of the African elephant.

Other authors have thought of establishing specific differences from the number of teeth existing at one and the same time in the jaw. Thus Merck (*Seconde Lettre sur les Os Fossiles de Rhinoceros,* Darmst. 1784, p. 12, et seq.) thinks he has established the difference between living and fossil elephants from the circumstance of the jaws he observed having only two teeth, while that of the elephant described by Daubenton had four. He fills eight pages with reasoning on this subject, and finishes by proposing an explanation of this variety in the number of teeth, similar to that of Pallas, by referring it to the difference of ages. M. Morozzo (*Mem. de la Societé Ital.* tom. x. p. 162) even informs us that the elephant has only one tooth on each side.

Some persons having been ignorant how these teeth diminish

minish in every respect before falling, and equally ignorant of the great difference between the teeth of young and old individuals, have imagined that the small teeth which are found isolated proceed from an elephant of a much smaller species.

But by far the most serious errors are those which have been occasioned by the partial laminæ of the germs of elephants' teeth which have been found detached and not at all worn.

The antient naturalists, who generally considered fossils as figured stones, found in these laminæ some resemblance to a foot or a hand, and gave them the name of *chirites*.

Kircher represents some of them under this name in his *Mundus subterraneus*, ii. 64. There are also similar ones in his museum, and in the *Museum metallicum Vaticanum* of Mercati.

Aldrovandus describes them by the same name, *De Metall.* lib. iv. 481.

But nothing of this kind approaches what we find in the *Rariora Naturæ et Artis* of Kundman, Pl. III. fig. 2. This author describes the object represented by his figure as the *petrified skull* of some great baboon; he asserts that the skin, the flesh, the nails, and the veins, were to be seen in it entirely petrified; that M. Fischer, professor at Konigsberg, who had seen the greatest part of the cabinets in Europe, regarded this petrifaction as one of the most singular in the world: and, lastly, that the king of Poland, when elector of Saxony, had offered him a considerable sum in order to place it in the cabinet of Dresden. *Walch*, in his commentary upon the work of Knorr, tom. ii. § 2. p. 150, quotes this rarity among the *osteolithes* of the ape, &c. A single glance, however, thrown upon the figure will show that it is merely a lamina of an elephant's tooth not yet worn at its extremity, nor soldered to the rest of the tooth.

Article V.

Comparison between the Grinders of the Indian and the African Elephant, and first distinctive Character of these two Species. Examination of various fossil Elephant Teeth.

For a long period teeth belonging to the elephants of India and those of Africa have been indiscriminately described, without comparing them, and without perceiving that they did not resemble each other in every particular. Thus the Royal Society of London, in 1715, caused to be represented, in order to serve as an object of comparison, some grinders from Africa, which considerably resemble, as we well know, those from India; and no person insisted upon any difference which might have escaped the eye.

The accurate and judicious Daubenton was equally far from remarking the difference, and Buffon and Linnæus never supposed there was any more than one species of elephants. We do not even perceive any traces of this discrimination in Gmelin's edition of the *Systema Naturæ*; and, in fact, all that is found in the antient authors and in travellers is vague, and can only be referred to simple varieties.

Such, for instance, are the assertions of the antients respecting the different degrees of the aptitude of these animals for war.

Diodorus Siculus, lib. ii. asserts that "the elephants of India far surpass in courage and strength those of Libya."

Appian confirms this, (*De Bellis Syriac.* ed. Amsterdam. 1670, 8vo. vol. i. p. 173.) According to him, "Domitius, who commanded the Romans against Antiochus, judging the elephants he got from Africa would be of no use to him, because they were smaller and because they were afraid of the large elephants, he ranged them behind the others," (*i. e.* behind the Indian elephants).

Pliny and Solinus remark generally that the African elephants were smaller than the Indian, and were afraid of them. It is extremely probable, however, that the elephants in the service of Hannibal and Jugurtha were of the former species only.

There

There is something more accurate, and equally true, in what is mentioned by a scholiast upon Pindar, cited by Gessner, *Quadr.*, p. 378, that the males only of the Indian elephants had tusks, but that both sexes had them among the elephants of Libya and Ethiopia. As to the distinction established by Philostratus* between the elephants of mountains, plains, and marshes, and as to the differences of their nature and of their ivory, it is also probable that if they were real they constituted simple varieties only.

The merit of the first legitimate specific distinction of elephants from the internal structure of their teeth is therefore entirely owing to P. Camper: although he has written nothing on the subject, the plates in which he has represented them, and the testimony of his son and of M. Faujas, secure this merit to him.

M. Blumenbach has also made the observation: he has characterized the two species according to this sole difference in his *Manuel*, sixth edition, p. 121, and has exhibited drawings of the two kinds of teeth in his *Abbildungen*, pl. 19.

This difference consists in the form of the laminæ and in their number; it is observable even in the germ.

The germs of the elephant from India are laminæ, each of which is formed of two surfaces nearly parallel, and simply furrowed in their length. (See Elephants, Plate III. fig. 5.) In the elephant from Africa, one of the surfaces, and often both, produces in its middle and upon nearly all its length an angular jet; its furrows are also much less numerous. (Fig. 6.)

It results from this structure of the germs, that the section of the laminæ, when the tooth has been worn, presents in the elephant of India narrow transverse stripes of an equal breadth, and the edges of which, formed by the enamel, are very much festooned; and in the elephant of Africa *lozenges* or stripes broader in the middle than at the two ends, and the edges of which are rarely frittered into very perceptible festoons.

* Vita Apoll. Tyan. lib. ii. cap. 12.

To this difference in form, may be added another in point of the number: the laminæ of the African elephant being broader, it requires less of them to form a similar length of tooth; nine or ten of these laminæ form a tooth as large as 13 or 14 of the Indian species would do.

It seems that these two species preserve the same proportion in teeth of the same age as in those of the same length. Thus, by comparing our skulls from Asia with those from Africa at nearly the same age, we find in the back teeth of the former 14 or 15 laminæ, and in those of the latter 9 or 10 only.

Besides, we never saw a tooth of the African species which had more than 10 laminæ, while those of the Indian species have, according to Mr Coxe, 23, and we have seen fossil teeth of this species having 24 and 25.

These characters, taken from the grinders, being once ascertained with respect to living elephants, it was natural to examine with this view the fossil elephants, since, with the exception of the tusks, the teeth are most frequently found and preserved.

The questions which occurred were the following:

Which of the two living species of elephants do the fossil teeth resemble most?

Do they resemble one of them entirely?

Are all fossil teeth similar to each other?

There is no doubt as to the first question. The greatest number of fossil teeth resemble at first sight those of the Indian elephant, and are composed, like the latter, of stripes nearly equal in breadth and festooned.

We may be certain of this by consulting Pl. VI. (marked Elephants) in which we have represented fossil teeth, both upper and lower, of different ages, and one half of their natural size.

Fig. 1. is a lower tooth of an old elephant, much worn, found last year in the forest of Bondy, with its next tooth.

Fig. 2. belongs to a very young elephant; a real young tooth from Fouvent.

Fig.

Fig. 3. is an upper tooth, from Siberia, of a middle-aged elephant: this is No. MXXII. of Daubenton.

Fig. 4. is one of the second teeth of the young elephant. It comes from the vicinity of Toulouse.

Fig. 5. a lower tooth of an old elephant, only half worn.

This general resemblance has induced Pallas, and almost all subsequent writers, to think that the fossil elephant is the same with that of Asia.

But is this resemblance complete? I denied it on another occasion (*Mem. de l'Instit. Classe de Math. et Phys.* tom. ii. p. 19). Since then, however, I have hesitated a little in maintaining an assertion which might appear conjectural, and as to which the observations of my learned friend M. Adrian Camper had inspired me with some doubts*. Let us again examine the matter impartially.

In the first place, it is certain that the number of the laminæ, considered by itself, cannot, as I thought, yield any good characters, since it is subject to vary according to the age of the individual and the place in which his tooth is situated, from four up to four-and-twenty.

But is the number always the same in teeth of equal length? This is what I have examined in a great number of teeth both of Indian and fossil elephants, and I have almost always found the laminæ of the latter thinner, and consequently more numerous, in the same space.

[To be continued.]

XI. *On the Phænomena of the Horizontal Moon.* By Ez. Walker, *Esq.*

To Mr. Tilloch.

SIR,

On looking over Young's Lectures on Natural Philosophy, lately published, I found in the second volume, p. 313, that the doctor has taken notice of my paper on the phænomenon of the horizontal moon, published in the ninth volume of the Philosophical Journal, and has marked it as "either

* Descrip. Anat. d'un Eleph., in fol. p. 19.

erroneous or unimportant:" in consequence of which I turned to the first volume, hoping to find some new hypothesis advanced by the doctor in his lecture upon this subject; but I was disappointed.

The doctor says, vol. i. p. 454, that "the sun, moon, and stars, are much less luminous when they are near the horizon than when they are more elevated, on account of the greater quantity of their light that is intercepted in its longer passage through the atmosphere; we also observe a much greater variety of nearer objects almost in the same direction: we cannot, therefore, help imagining them to be more distant when they rise or set than at any other times; and, since they subtend the same angle, they appear to be actually larger. For similar reasons, the apparent figure of the starry heavens, even when free from clouds, is that of a flattened vault, its summit appearing to be much nearer to us than its horizontal parts, and any of the constellations seems to be considerably larger when it is near the horizon than when in the zenith."

This explanation seems to be derived from the hypotheses of Des Cartes and Berkeley; but the reader shall judge for himself.

"Des Cartes*, and from him Dr. Wallis and most other authors, account for the appearance of a different distance under the same angle, from the long series of objects interposed between the eye and the extremity of the sensible horizon; which makes us imagine it more remote than when in the meridian, where the eye sees nothing in the way between the object and itself. This idea of a greater distance makes us imagine the luminary the larger; for an object being seen under any certain angle, and believed at the same time very remote, we naturally judge it must be very large to appear under such an angle at such a distance."—Hutton's Mathematical Dict. vol. ii. p. 74.

Mr. Molyneux says (Philos. Trans. Abr. vol. i. p. 221), "that if the hypothesis of Des Cartes be true, we may at any time increase the apparent magnitude of the moon even

* Des Cartes was born in 1596.

in

in the meridian; for, in order to divide the space between it and the eye, we need only to look at it behind a cluster of chimneys, the ridge of a hill, or the top of a house," &c. He further observes, "that when the height of all the intermediate objects is cut off, by looking through a tube the imagination is not helped, and yet the moon seems still as large as before."

Dr. Smith says in his Optics, vol. ii. p. 55, of the Remarks, that in Berkeley's Essay towards a New Theory of Vision * there is the following solution:

"Between the eye and the moon, when situated in the horizon, there lies a far greater quantity of atmosphere than there does when the moon is in the meridian. Whence it comes to pass that the appearance of the horizontal moon is fainter; and therefore, by sect. 56, it should be thought bigger in that situation than in the meridian, or in any other elevation above the horizon."

"But," says Dr. Smith, "to avoid entering into a particular consideration of his arguments, I choose to show, from experience only, that these various degrees of the moon's faintness make no sensible variation of her apparent magnitude; which, I think, will be evident by the following observations:

"First, that the moon appears much fainter in the daytime than in the night, and therefore, according to our author's principle, should appear larger; which I could never perceive, though I have often viewed the moon for this purpose.

"Secondly, I observe that the moon when totally eclipsed appears much fainter than she does at the same elevation when not eclipsed, but does not appear larger than usual, as I am fully satisfied by the total eclipse of the moon on Nov. 20, 1732.

"Lastly, I observe that this hypothesis of faintness can scarce be thought sufficient, by any means, to account for the like variety of the apparent magnitudes of the constellations; that is, of the intervals of the same fixt stars at va-

* Published in 1709.

rious altitudes; which yet is allowed to be a phænomenon of the same kind and degree as that of the sun and moon, and consequently to depend upon the same cause."

No attempt, I believe, has yet been made to prove the truth of either of these old theories experimentally; but, on the contrary, the experiments and observations of Molyneux and Smith show that they are both fallacious.

From some experiments which I have lately made, it appears that the apparent magnitudes of all objects vary, as well as those of the sun and moon.

I am, sir,
Your most humble servant,
EZ. WALKER.

Lynn;
Oct. 17, 1807.

XII. *Report of the Senior Chaplain of Fort St. George to the Right Honourable Lord* WILLIAM BENTINCK, *Governor of Madras, on the State of the Christians inhabiting the Kingdoms of Cochin and Travancore.*

Public Department.

To the Rev. Dr. Kerr, Senior Chaplain of Fort St. George.

Reverend Sir,

THE right honourable the governor in council being desirous of availing himself of your vicinity to the Malabar coast, to obtain every possible information in regard to the establishment, &c. of the Christian religion in that part of the peninsula, I am directed by his lordship in council, to desire, that so soon as the state of your health and the season will permit, you will proceed to the provinces on that coast; and you will forward to me, for the information of government, such accounts as you may be able to collect of the first introduction of christianity into India; of the arrival of the different sects who have been or may be in existence; of their general history, and of the persecutions to which they may have been exposed; of their success in making proselytes; of their church establishment, and of the source from

from which they are maintained, and with all other circumstances connected with this important subject.

I have the honour to be, rev. sir,
Your most obedient humble servant,
(Signed) G. G. KEBLE,
Sec. to Government.

Fort St. George,
June 28, 1806.

To the Right Honourable Lord William C. Bentinck, Governor in Council, &c. &c.

My Lord,

When at Mysore I was honoured by the receipt of Mr. Secretary Keble's letter, dated the 28th of June last, and, finding my general health much improved, I resolved to proceed to the Malabar coast in search of the information required by your lordship in council, regarding the Christians inhabiting that part of the peninsula; an investigation which I have found as interesting as it is important, whether it regards humanity at large, or as it is connected, in a political view, with the British interests in this country.

To view the extensive field pointed out for my inquiries minutely, would require much more of my time than could be well spared from my other public avocations; and as I learned that the reverend Dr. Buchanan was nominated by the government of Bengal to travel over the same ground for purposes somewhat similar, I did not think it incumbent on me to take up more than a general view of the subject, and I directed my attention accordingly, not so much to details as to matters of comprehensive import.

The first object to which the orders of government refer is, to an account of the introduction of Christianity into this country.

There can be no doubt whatever that the St. Thomè Christians settled on the Malabar coast at a very early period of the Christian church; from whence they, at one time, spread in various directions as far even as Mileapoor and St. Thomas's Mount: but to derive *authentic* information as to the time of their arrival, is at present no easy task.

From the confusion arising from the imperfection of

Hindoo chronology, from the desire which these Christians have to derive their origin from the earliest possible times, (which may perhaps have introduced false traditions amongst them,) and as all their authentic records are reported to have been destroyed during the persecutions of the church of Rome; from all these circumstances, whether we refer to the Hindoo accounts, to the St. Thomê Christians themselves, or to their persecutors the Roman catholics, we are not likely to arrive at any certain conclusion as to the exact time of their establishment in Malabar. Some circumstances, however, may be collected from undoubted authority, by which it may be inferred that they have been for nearly fifteen centuries established in India; for we find in Ecclesiastical History, that at the first council at Nice, in the year 325, a bishop from India was amongst the number composing that memorable synod; and, in the creeds and doctrines of the Christians of Malabar, internal evidence exists of their being a primitive church; for the supremacy of the pope is denied, and the doctrine of transubstantiation never has been held by them; and they regarded, and still regard, the worship of images as idolatrous, and the doctrine of purgatory to be fabulous: moreover, they never admitted as sacraments extreme unction, marriage, or confirmation: all which facts may be substantiated on reference to the acts of the synod established by don Alexis de Meneses, archbishop of Goa, at Udiamper, in the year 1599.

The history of this council will be found most ably detailed in a work printed in French, and entitled "The History of Christianity in India," published at the Hague in the year 1724 by La Croze, the celebrated librarian to the king of Prussia.

The object of this work was to deduce, from authentic materials, the rise, progress, and establishment of Christianity in the East; and to hold up to disgrace and to merited indignation the bigoted and unworthy conduct of the Roman catholic church in the persecution set on foot by her emissaries, under her avowed sanction, against the primitive Christians who were found settled on the coast of Malabar;

Malabar; and La Croze seems to have discharged his duty to the public in a most faithful, interesting, and able manner.

When the Portuguese first arrived in this country, in the beginning of the 16th century, they found a Christian church using the Syrio-Chaldaic language established in the neighbourhood of Cranganore; and, though it was published to the world many centuries before that period that such a church existed, yet we find their ignorance expressed in the wonder which it excited.

These Christians met the Portuguese as natural friends and allies, and rejoiced at their coming; but the Portuguese were much disappointed at finding the St. Thomé Christians firmly fixed in the tenets of a primitive church, and soon adopted plans for drawing away from their pure faith this innocent, ingenuous, and respectable people: however, after using, for nearly a century, all the customary arts and abominable persecutions of the church of Rome to no purpose, don Alexis de Meneses, the archbishop of Goa, appeared amongst them; and, by his commanding influence, his zeal, and his learning, and on the authority of what he called the council of Udiamper, forced the Syrian metropolitan, his priests and people, into the Roman pale. The archbishop, however, had not long quitted the scene of this triumph of bigotry, ere the people sighed for their old religion, and cherished it in private; but on the 22d of May 1653 they held a congress at Alingatte, and great numbers, headed by their metropolitan, revolted publicly from the Romish communion; nor has all the influence of the Roman pontiff, and the kings of Portugal, been able to draw them away again from their old faith.

Leaving the history of this interesting people, which is affectingly delineated in La Croze's book, I shall, in this report, confine myself more particularly to the existing state of Christianity in Malabar; and, in order that your lordship may have the subject clearly before you, I shall consider each sect of Christians by itself, under the head of, 1st, St. Thomé, or Jacobite Christians; 2dly, The Syrian Catholics, who have been forced from the Jacobite church into the Romish pale; and, 3dly, The Latin church.

St. Thomé, or Jacobite Christians.

These people, who still retain their antient creed and usages, consider themselves as the descendants of the flock established by St. Thomas, who is generally esteemed the apostle of the East. Their ancestors emigrated from Syria, and the Syrio-Chaldaic is the language in which their church service is still performed. They admit no images within their churches, but a figure of the Virgin Mary with the child Jesus in her arms, which is considered merely as an ornament, and not a subject for idolatrous worship. They are generally denominated by the country people Nazaranee Mapilles. Nazarance is obviously derived from Nazareth, but the origin of the word *mapillah* is variously accounted for: by some it is ingeniously supposed to refer to the Virgin and Child, the only image admitted within their churches; as *ma* implies mother in various languages, derived from the Sungscrit; and *pillah*, child. Others again, construe the term to indicate the rank originally conferred on these Christians by the sovereign of Malabar. *Poolah* signifies *a class*, in a state synonymous with our secretaries. *Ma* or *maha* signifies *great* or *superior*. The term Mapillah is indiscriminately applied to Jews and Musselmen as to these Christians, distinguishing each by the prefix of the Jew, Syrian, or Nazaranee, or Musselman.

It is certain that grants of honour and emolument were formerly possessed by these Christians, given to them by a king of Malabar named Peremaul, engraven on copper, five of which engravings are still in existence; a *fac-simile* of which I have seen in the possession of the resident of Travancore.

It has been long believed that these Christians held the tenets of the Nestorian heresy, and that they were obliged to leave their own country in consequence of persecution: however, it appears that the creed which they now follow denies that heresy, and seems to coincide in several points with the creed of St. Athanasius, but without its damnatory clauses.

Baron Von Wrede has written a memoir on the subject of

of these Christians, which appeared in the seventh volume of the Asiatic Researches, and which has the merit of calling our attention to these people; though it is no better than a lame transcript of information, which may be fully and satisfactorily obtained in La Croze's book, from whence every material part of that memoir is obviously taken: indeed, wherever the baron departs from his author he becomes less interesting, or misleads his reader. That the Christians in Malabar were early taught the tenets of Nestorius, is proved by La Croze on the direct authority of Cosmas, an Egyptian merchant (himself a Nestorian), who published his voyage to India in the year 547. It seems, however, not improbable that Christians had been planted in these shores long before the time of Nestorius; and I am inclined to regard the tradition of its having spread hither in the age of the apostles, as very far from fabulous*.

With respect to their religious tenets, writers may, and will, disagree; upon such subjects human reason avails nothing. The disputes which on these points have agitated the world, are in general no better than the perverse offspring of verbal differences.

The following is a version of the present creed of these people, being a written communication from the metropolitan to the resident at Travancore:

"In the name of the Father, Son, and Holy Ghost, we, the Christians, believers in the religion of Jesus Christ, subject to the jurisdiction of Mar Ignatius, patriarch of Antioch, being loyal Jacobians †, hold the following creed:

"We believe in the Father, Son, and Holy Ghost, Three Persons

* Eusebius informs us that there were Christians in India as early as the year 189, who had the Gospel of St. Matthew in Hebrew, which they declared was received from St. Bartholomew.

† Eastern Christians, who renounce the communion of the Greek church, and differ from it both in doctrine and worship, may be comprehended under two distinct classes. To the former belong the Monophysites or Jacobites, so called from Jacob Albardai, who declare it as their opinion, that in the Saviour of the world there is only one nature; while the latter comprehends the followers of Nestorius, frequently called Chaldeans, from the country where they principally reside, and who suppose that there are two distinct persons or natures in the Son of God. The Monophysites are subdivided into two sects

or

Persons in One God, neither confounding the persons nor dividing the substance, One in Three, and Three in One.

" The Father generator; the Son generated; and the Holy Ghost proceeding.

" None is before nor after other in majesty, honour, might, and power; co-equal, unity in trinity, and trinity in unity.

" We do not believe, with Arius and Eunonimus, that there are three different and separate substances.

" We do not believe, as Sabellius believes, by confusion of substance.

" We do not believe, as Macedonius said, that the Holy Ghost is less than the Father and Son.

" We do not believe, as Mawney and Marcianus* said, that the body of Christ was sent down from heaven.

" We do not believe, as Julianus† said, that Christ was only man.

" We do not hold, as Nestorius, the doctrine of two natures and two substances in the Messiah.

" We do not believe, as the Chalcedonians said, that there are two natures in the Messiah.

" But we believe, by the doctrine of the Trinity, that the Son is coequal with the Father, without beginning or end; that in the appointed time, through the disposition of the Father and Holy Ghost, without disjoining from the right

or parties; the one African, and the other Asiatic. At the head of the Asiatics is the patriarch of Antioch, who resides, for the most part, in the monastery of St. Anarias, which is situated near the city of Merdin, and sometimes at Mercin, his episcopal seat; as also at Amida, Aleppo, and other Syrian cities. The government of this prelate is too extensive, and the churches over which he presides too numerous, to admit of his performing himself all the duties of his high office; and therefore a part of the administration of the pontificate is given to a kind of colleague, who is called the Maphrian, or Primate of the East, and whose doctrines and discipline are said to be adopted by the eastern church beyond the Tigris. This primate used formerly to reside at Tauris, a city on the frontiers of Armenia; but his present habitation is the monastery of St. Matthew, which is in the neighbourhood of Mousul, a city of Mesopotamia. It is further observable, that all the patriarchs of the Jacobites assume the denomination of Ignatius.—Mosheim, vol. iv. sect. xi. p. 257.

* These, I suppose, might be Manes and Marcion.

† Perhaps Julian, bishop of Hallicarnassus.

side

side of the Father, he appeared on earth for the salvation of mankind: that he was born of the Virgin Mary, through the means of the Holy Ghost; and was incarnate, God and man. So that in the union of the divine and human nature there was one nature and one substance.—So we believe."

The service in their church is performed very nearly after the manner of the church of England; and when the metropolitan was told that it was hoped that one day an union might take place between the two churches, he seemed pleased at the suggestion.

The present metropolitan, Mar Dionysius, is now old and infirm, but a very respectable character, and of the most venerable and prepossessing appearance. A person has been sent from Mousul, a city in Mesopotamia, to succeed to his station in the event of his decease; but this stranger, ignorant of the language of the country, with the character of being violent in his temper, and not averse, as it is supposed, to the views of the Romish church, it is to be hoped will be prevented from ever taking charge of this precious remnant of a pure and valuable people.

The metropolitan has several archdeacons and deacons under him, who act as vicar-generals. They have fifty-five churches; and the number of their people, as given in to the resident, is estimated at 23,000.

The residence of their metropolitan is at Candenatte, twelve or fourteen miles inland from Cochin. In some of their churches divine service is performed in the Syrian and Latin ritual alternately, by the priests of the Christians of St. Thomê, who have adhered to their antient rites, and those who have been united to the church of Rome*. When the latter have celebrated mass, they carry away the images from the church before the others enter.

The character of these people is marked by a striking superiority over the heathens in every moral excellence; and they are remarkable for their veracity and plain dealing. They are extremely attentive to their religious duties; and abide by the decision of their priests and metropolitan in

* This shows a spirit of toleration and Christian liberality very different from the bigotry of the Romish church.

all

all cases, whether in spiritual, or, as I heard, in temporal affairs. They are respected very highly by the Nairs, who do not consider themselves defiled by associating with them, though it is well known that the Nairs are the most particular of all the Hindoos in this respect; and the rajahs of Travancore and Cochin admit them to rank next to Nairs. Their numbers, it is conjectured, are under-rated in the statement given to the resident, as it is generally supposed that they may be estimated at 70 or 80,000. They are not persecuted, but they are not permitted to make converts by the governments under which they reside; and it is supposed that many respectable Hindoos would be happy to join their sect, were it not for this circumstance: but at present they suffer, as far as I can learn, no other hardship.

If good men from Syria could be obtained, not as parish priests, but to superintend and regulate their concerns, I conceive it would be a great blessing to these good people.

The direct protection of the British government has been already extended to them; but, as they do not reside within the British territories, I am somewhat doubtful how far it may be of use to them.

To unite them to the church of England would, in my opinion, be a most noble work; and it is most devoutly to be wished for, that those who have been driven into the Roman pale might be recalled to their antient church; a measure which it would not, I imagine, be difficult to accomplish, as the country governments would, it is supposed, second any efforts to that purpose.

Their occupations are various as those of other Christians; but they are chiefly cultivators and artisans; and some of them possess a comfortable, if not a splendid, independence. Their clergy marry in the same manner as protestants. Their residence is entirely inland.

Syrian Roman Catholics.

These people, as stated above, were constrained to join the Latin church, after a long struggle for the power of maintaining their purity and independence; and still appear a people perfectly distinct from the Latin church, being allowed

lowed to chant and perform all the services of the church of Rome in the Syrio-Chaldaic language by a dispensation from the pope. They live under the authority of the metropolitan of Cranganore and the bishop of Verapoli, and dress differently from other priests. They wear a white surplice, while the priests of the Latin communion wear black gowns like the Capuchin friars of Madras. The Roman catholic Syrians, it is thought, are much more numerous than the members of the original church. Their clergy are spread through the antient churches, and, by retaining their language, and acting under the direction of the church of Rome, they leave no means unessayed to draw over their primitive brethren to the Latin communion. It appears to me that they are allowed to use their original language, and to frequent the original church, entirely with this view; and, as far as I can learn, their numbers are gaining ground. There are said to be eighty-six parishes of Roman catholic Syrians subject to the dioceses of Cranganore and Verapoli. Their priests, to the number of 400, are styled Catanars, which is a Syrian appellation; their congregations are reported at 90,000 (old and young included), agreeably to the last returns transmitted to Rome. There is an inferior order of priests, who are called Chiamas, in number about 120. The Hindoos have, as far as I can learn, a much greater respect for the Christians of the original church than for the converts of the Latin communion; which may be accounted for by their not associating with the lower orders of people. Attached to each church is a convent, where the Catanars reside in community, there being three, four, or five, to each church. The service is performed weekly, in rotation. There is a seminary at the college of Verapoli for the education of the Syrio-Roman catholics, and also one for the Latin church. The Syrio-Roman catholics are chiefly engaged, as already mentioned, in drawing their antient brethren within the Romish pale; but it appears that some of them have been employed formerly in extending the general object of conversion over the peninsula. I saw one of their churches, at a village near Pillimbaddy, about thirty miles on the Madras side of Trichinopoly; and I heard of several others.

They

They had at this village adopted the use of a sawmy coach, like that of the heathens, with the crucifix and the Virgin Mary in it, instead of the Hindoo sawmy. Their church was much out of repair; and the ignorance of the few Christians remaining in charge of it is striking: the letters I, N, R, I, over the figure of our Saviour on the cross, being absolutely inverted; nor did the priest who visits them ever notice the circumstance. They read prayers in Malabar according to the ritual of the church of Rome. Their church appears to have been once respectable, but is now fallen into decay.

Latin Roman Catholics.

Within the provinces of Travancore and Cochin there are one archbishop and two bishops; the archbishop of Cranganore, and the bishops of Cochin and Verapoli.

The two former have sees, the latter is titular. The archbishops of Cranganore and the bishop of Cochin are nominated by the queen of Portugal, after the following manner: three names are sent (when either of these sees becomes vacant) by the sovereign of Portugal to the pope; and the Roman pontiff is bound to select the name that stands first, and to issue his brevet or patent accordingly.

They are subject in all spiritual concerns to the primate of Goa; who has also the power, during a vacancy, of sending from Goa a *locum tenens*, who is styled *padre governador*. Both sees are at this moment filled by such.

The titular bishop, who resides at the college of Verapoli, is appointed directly by the pope, and is subject to no jurisdiction but that of his holiness, or the Propaganda at Rome. This mission, being more susceptible of control and regulation than the others, has been countenanced by the honourable Company, as the following copy of a proclamation issued by the government of Bombay will show.

Proclamation.

The honourable the court of directors of the honourable English East India company, having been pleased to order that the ecclesiastical jurisdiction of the Roman catholic churches under this government shall be withdrawn from the

the archbishop of Goa, and restored to the Carmelite bishop of the apostolic mission, the president in council has accordingly resolved, that the said restitution shall take place on the 1st of the ensuing month; from which time he hereby enjoins all the catholic inhabitants in Bombay, as well as the several factories and settlements subordinate thereto, to pay due obedience in spiritual matters to the said bishops on pain of incurring the severe displeasure of government.

By order of the honourable the governor in council,

Bombay Castle, Aug 2, 1791. (Signed) WILLIAM PAGE, Secretary.

The priests attached to the college of Verapoli are all Carmelites, united to the apostolic mission at Bombay, but not subject to it. The jurisdiction of each is not marked by distinct bounds; the parishes and churches being so intermingled, that it is difficult to form a right notion of their extent. The bishop of Cochin, however, may be said to have a control over all the Romish churches situated on the sea-coast immediately (with few exceptions) from Cochin to Ramnad, and thence round the whole island of Ceylon: the churches are numerous; but as they are in general poor, and are obliged to be supplied with priests from Goa, it would appear that one vicar holds, upon an average, five or six churches. The number of Christians composing these churches must be great, as all and every of the fishermen are Roman catholics. The bishop of Cochin usually resides at Quilon. There are very few European clergy (not above seven or eight) under the three jurisdictions, and none of them men of education; and it cannot be expected that the native priests, who have been educated at Goa, or at the seminary at Verapoli, should know much beyond their *missals* and *rituals*. The Latin communicants in the diocese of Verapoli are estimated at 35,000. The catechumen suffers no persecution on account of his religion when once converted; but the country governments are excessively jealous upon this point, and do their utmost to discountenance any conversion.

The converts are from various casts, viz. Chegas or Teers, Muckwas and Pullers; and there can be no doubt but that many

many of higher casts would be baptized if they did not dread the displeasure of their governments.

It is well known that the Roman religion was introduced by the Portuguese at the commencement of the sixteenth century; the number converted in each year, upon an average, reach to nearly 300: the number, of course, naturally diminishes. The morality of the converts is very loose; and they are generally inferior, in this respect, to the heathens of the country.

General Observations.

Reflecting on the whole subject, several suggestions present themselves to my mind; and I think I shall not be considered as deviating from the line of my profession, or the intention of your lordship in calling for my report, by offering some opinions to government, which, in a moral and political view, seem of the highest importance. It appears from the foregoing statement, that pure Christianity is far, very far, from being a religion for which the highest cast of Hindoos have any disrespect; and that it is the abuse of the Christian name, under the form of the Romish religion, to which they are averse. We have, my lord, been sadly defective in what we owed to God and man since we have had a footing in this country, as well by departing most shamefully from our Christian profession ourselves, as in withholding those sources of moral perfection from the natives which true Christianity alone can establish; and at the same time we have allowed the Romanists to steal into our territories, to occupy the ground we have neglected to cultivate, and to bring an odium on our pure and honourable name as Christians. The evil would be less were it not well known that many of the Romish priests, and their people, who have thus been allowed to grow numerous under our authority, are supposed to be far from well affected to the government under which they reside: indeed, in many instances the Roman clergy are the natural subjects of nations at enmity with ourselves, at the same time that they are eminently qualified, by their influence in their profession, to do us the greatest mischief, by spreading disaffection throughout

throughout every part of the extended country. The Roman catholic religion, my lord, I believe I may say, without offence to truth or charity, has almost always been made a political engine in the hands of its governments; and we must be blinded indeed by our own confidence, if we do not calculate on its being so used in this great and rich country, where it has established a footing amongst an ignorant people; especially when it is so well understood that our eastern possessions have been a subject of the greatest jealousy to all the rival nations of Europe. In my humble opinion, my lord, the error has been in not having long ago established free-schools* throughout every part of this country, by which the children of the natives might have learned our language, and got acquainted with our morality. Such an establishment would, ere this, have made the people at large fully acquainted with the divine spring, from whence alone British virtue must be acknowledged to flow. This would have made them better acquainted with the principles by which we are governed; they would have learned to respect our laws, to honour our feelings, and to follow our maxims; whereas they appear to me, generally speaking, at this moment, as ignorant of their masters as on their first landing on these shores. I speak not of interfering with their religious prejudices, or endeavouring to convert the natives by an extraordinary effort on the part of the British government. Conversion, in my opinion, must be the consequence which would naturally flow from our attention to

* To give English morals to the natives in their purity, we must, I imagine, make them read English books. Translations have hitherto been very defective in the different country languages; besides, they must be extremely circumscribed in number. I do not think the natives will come to us freely but to learn English. This they consider as the key to fortune; and, on the coast, the most strict of the bramins will have little hesitation, as far as I can learn, in permitting their children to attend a free-school for the purpose of learning it; for they despise us too much to suppose there is any danger of overturning the principles of braminism. But their ill-founded, ridiculous principles must be shaken to the very foundation by the communication of such liberal knowledge as a Christian can instil into the minds of youth, and fix there by means of English books; and all this without making any alarming attack directly on the religion of the Hindoos.

their moral instruction, and their more intimate acquaintance with the English character.

I do not mention this as an experiment, the result of which might be considered as problematical: the experiment has been already made, and the consequences have proved commensurate with the highest expectation which reasonable men could entertain. The Danish mission, united with the Society for propagating the Gospel, have sent some good men into this country with the laudable view of spreading true Christianity throughout our eastern possessions; and the names of Swartz, Gerricke, and others, will ever be remembered by numbers of our Asiatic subjects, of every cast and description, with veneration and affection; and there are happily still living some amongst us of the same character.

It is true, that the object they had more particularly in view has, in some measure, failed; and few good converts, it is generally imagined, have been made: but let it be remembered also that they have laboured under every possible disadvantage; they have scarcely enjoyed a mere toleration under our government, and received no kind of assistance whatsoever; that they were few in number, and perhaps I may say, without injustice, that they erred (as the best might err) in the means which they adopted; but that they have done much good by the purity of their lives, and by their zeal in spreading instruction. This will admit of no denial; and I doubt not that I may say, without the danger of contradiction, that few and poor as these men have been, without authority or power to support them, a greater and more extended portion of heartfelt respect for the European character has been diffused by their means throughout this country than by all the other Europeans put together. We have, in my humble opinion, my lord, kept ourselves too far from the natives; we have despised their ignorance, without attempting to remove it; and we have considered their timidity (the natural result of their being trampled upon by one race of conquerors after another) also as an object for our contempt; at the same time that we have viewed the cunning of their character (which

is

is ever the natural resource of ignorance and weakness) as the completion of all that is vile and deceitful. Thus have we continued a system of neglect towards the interests of our native subjects in points the most essential to their every happiness, throughout the whole of our governments in this country. Fain, my lord, would I see a change in this particular; and I seize the opportunity which the present moment affords, to press the justice and the policy of the measure on the attention of your lordship's government.

Having the honour to remain,
With the highest respect, my lord,
Your lordship's faithful and obedient humble servant,
(Signed) R. H. KERR,
Senior Chaplain of Fort St. George.

Madras,
Nov. 3, 1806.

XIII. *Report of Surgical Cases in the Finsbury Dispensary from the Beginning of February to the End of April* 1807; *with the Appearances, on Dissection, in a Case of Aneurism; and some Observations on that Disease, by* JOHN TAUNTON.

DURING the above three months there were admitted 259 patients.

Cured or relieved - -	227
Died - - - -	1
Under cure - - -	31
	259

In the Philosophical Magazine for December 1806, a case of aneurism is noticed, with the intention of being reported on.

J. J., æt. 55, was admitted a patient of the Finsbury Dispensary on the 13th of November last. From his own account his health had been declining for about the space of three years, and about the beginning of July 1806 he observed a swelling on the left side of his neck, immediately

above the sternum; which now (Nov. 13th) extended from the upper part of that bone to the superior part of the larynx, with extremely strong pulsations, corresponding with the motions of the heart, which were irregular. The tumour readily disappeared on continued pressure, but on that being removed it immediately resumed its former size and appearance. He died on the 26th of the same month.

On raising the sternum the aneurismal sac was in close contact with the internal and superior part of that bone, but did not contain "one particle" of coagulated blood: the origin of the sac was from the superior part of the curve of the aorta, immediately on the right side of the left carotid artery: the opening by which it communicated with the aorta was about a quarter of an inch in diameter: the ascending aorta was enlarged and *ossified* in several points: the muscular substance of the left ventricle of the heart was much thickened.

The lungs were healthy, as well as the abdominal viscera.

The dissection of this, together with similar cases in my possession (the preparations of which are preserved), in which this disease has proceeded till it terminated the existence of the individual sufferers, without any *coagulum being formed in the aneurismal sac*, are strongly opposed to an opinion advanced in Mr. John Bell's Surgery. "It is not less imaginary," says that author, "that the blood can be pushed back from the aneurismal bag into the artery; there is no such thing, it is a mere delusion; as the blood coagulates very soon, and does not contain one particle fluid enough to be returned into the vessel."

It is also considered by many, that in the operation for aneurism and wounded arteries, where it is necessary to take up the vessel, the passing of two ligatures round the vessel and dividing it between the ligatures, is of modern invention; but it appears that this mode of operating was known to Parée, Fabricius, and others.

"Sometimes, also, the surgeon needs to cut the vessel entirely across, by which its ends shrinking both ways among

among the flesh the flux stops; but always the surest way is to tie the vessel before cutting it thus across*."

"Deinde partes utrinque, filo ligare, et transversum totum vas prescindere†."

JOHN TAUNTON,
Surgeon to the City and Finsbury Dispensaries, Lecturer on Anatomy, Surgery, Physiology, &c.

Greville-street, Hatton-garden,
October 23, 1807.

XIV. *Proceedings of Learned Societies.*

FRENCH NATIONAL INSTITUTE.

[Continued from vol. xxviii. p. 372.]

WHILE a noble spirit of rivalship pervades the candidates, the botanists who are members of the class, by continuing their labours, have shown themselves worthy of being the chief judges of this great assembly.

M. Ventenat is proceeding with his work upon the Garden of Malmaison. A new number, being the 20th, has recently appeared.

The first of the species which are there described is a superb original leguminous plant from Botany Bay, and which presents in the organs of fructification characters which have not been as yet observed in the vegetables of this family. M. Ventenat does not hesitate to make a new genus of it, to which he has referred a species also cultivated at Malmaison, although it has not as yet flourished; but it resembles the former so much in its appearance, that it is almost certain it must conform to it in the organs of fructification.

The second of these species is an original malvaceous plant from the Canaries, the flowers of which are as large as those of the garden ketmia, and are of a fire-red colour, which is extremely rare in the plants of this family. This work of M. Ventenat must occasion the friends of science

* Parée. † Fabricius.

to regret that, from the state of his health, the author is under the necessity of suspending his labours.

M. de la Billardiere has arrived at the 82d number of his *Flora of New Holland*. Five new genera are there described, one of which, in particular, which M. de la Billardiere calls *atherosperma*, and which seemed to him to belong to the family of the *ranunculi*, is a tree which is likely to become useful to France, because its almonds have the taste and flavour of nutmeg, and it is likely to be capable of supporting the temperature of our climate.

One of our most celebrated correspondents, M. de Humboldt, continues to publish, along with his fellow-traveller M. Bonpland, the plants they have discovered in *Equinoxial* America. Two numbers of this have been already published. The family of the *melastoma* alone will be indebted to these learned travellers for so great a number of new species, that they might form a volume by themselves.

Messrs. Humboldt and Bonpland have not been less industrious in the natural history of animals.

The condor, the bird so famous in the Cordilleras, has never been described before their time in an uniform manner, and the size of it has been much exaggerated.

It is scarcely above one metre in height, nor more than three or four metres in thickness. Its colour is generally of a blackish brown: the lower part of the neck is furnished with a kind of collar of white feathers. The male is distinguished by a fleshy crest upon the crown of the head, and by a white spot upon the wing; distinctions which the females have not.

The observations of these two travellers upon the electrical eel of Surinam (*Gymnotus electricus*) are very curious. (*Vide* Phil. Mag. vol. xxiii. p. 356.)

M. Tenon has given an important continuation of his Memoirs upon the Dentition of the Horse.

After briefly recapitulating the results he had presented in former years, he dwells at considerable length upon the back teeth, or the three teeth of each jaw.

The lower teeth have two roots; those above have three.

The

The fusts of the former are thinner, and crooked from front to rear; those of the rest are crooked towards the palate: this curvature distinguishes them from the front grinders, whether they are the milk teeth * or those which succeed to them, which are straight.

The former of these back grinders are visible in the alveolus at the time of birth; they come out at nine months, and last all the life of the animal: they have also more length for wearing down by mastication than all the rest. The first and second have behind a small longitudinal ridge, which assists them in cutting the alveolus, but which is speedily followed by a plane surface destined to support the tooth which comes from behind. The third back tooth, on the contrary, not being to be followed by any other tooth, preserves its ridge throughout its whole length; but it has a small swelling which hinders it from opening the alveolus so rapidly as the others. All these teeth, in developing themselves, cause upon the jaw the effect of an expansive instrument, which dilates it unequally, and varies the form of it according to the age of the animal and conformably to the wants of every period of life.

It is only by thus studying nature, in the minutest details of her works, that we are competent to admire them as we ought; but how difficult is the study! The description of the horse alone, has occupied the attention of M. Tenon for these many years.

The same respectable anatomist has also recently published the first volume of his "*Recherches d'Anatomie et de Chirurgie.*" He principally treats of the eyes, their diseases, the exfoliation of the bones, and he has inserted several of the memoirs which we have noticed in our former reports. This work, destined for men of science, cannot be sufficiently analysed in a report of this nature.

M. Cuvier continues his researches into the origin of those animals whose skeletons the revolutions of the earth have brought to light.

* Those which make their appearance when the animal is suckling.

M. de Beauvois has published the third part of his *Insectes recueillis en Afrique et en Amerique.*

The history of animals, although placed at the limits of the physical and moral sciences, does not employ alone, in its discussions, the theory of the action of bodies; that of the operation of mind also is not foreign to it.

We know, for example, that the nature and the limits of the intelligence of the brute creation have for a long time occupied metaphysicians, although these are points that can be determined by naturalists only.

In this last respect such subjects become proper objects of inquiry to our class; and it is for this reason we heard with much interest a memoir upon instinct, or rather *against instinct*, which was read to us by M. Dupont de Nemours, member of the historical class.

Considerations foreign to the subject formerly rendered this description of subjects complicated, and Descartes fell into an opposite extremity by making the brutes to be pure machines.

If we did not know, by so many experiments, how far the spirit of system has sometimes led the greatest of men, we might be tempted to think that they were not serious.

Since philosophers, however, have found it more advantageous to observe simple nature herself, than to create an imaginary one, they have returned to a train of thinking on the subject, similar to that of the vulgar.

No one of common understanding doubts that animals are conscious of their sensations, and are determined in their actions by the pleasure or pain of the moment: but further, every person admits that they have a strong memory; that they form, by repeated experiments, general judgments founded upon the sentiment of analogy; and that they afterwards conduct themselves according to the pleasure or pain these decisions make them feel, and often in spite of the actual attraction of a present pleasure or pain: lastly, that these methods, well directed, can be employed by mankind in their education, and may lead them sometimes to assume the habit of performing with admirable precision, actions

not only extremely difficult in themselves, but to which even this conformation does not seem adapted.

None of these philosophers doubt that animals have various ways of expressing their wants and their passions, and that those of a superior order, i. e. those which approach ourselves in their organization, are capable of learning the signification of several of our words, which they obey without committing any mistakes.

But, independently of these faculties which resemble ours in some respects, and which also vary in a considerable degree in the different classes of animals, naturalists think they have discovered in certain species, other faculties which seem to be essentially different, and to which they have given the name of *instinct*.

There are certain actions necessary to the preservation of the species, but often entirely foreign to the apparent wants of the individuals, often also very complicated, which, were we to attribute them to intelligence, would presuppose a foresight and knowledge, which none have yet ventured to ascribe to these species; actions which cannot be attributed to imitation, because the individuals who perform them often appear to be incapable of having been taught them, and yet those of the same species exercise them always nearly in the same manner: lastly, what is not less remarkable, actions which have no reference whatever to the degree of ordinary intelligence, and which become more singular, more acute, and more disinterested, in proportion as the animals which perform them belong to classes less elevated and more stupid. It is among the insects, the *mollusques*, and the worms, that we observe the most surprising instincts: it seems that instinct and intelligence are two faculties given in order to compensate the want of each other, as, in other respects, fecundity supplies the place of strength or longevity: it is ever by the just proportion of intelligence, instinct, and physical qualities, such as the delicacy of the senses or the strength of the body, that the species are preserved.

[To be continued.]

XV. *In-*

XV. *Intelligence and Miscellaneous Articles.*

NEW COMET.

THE appearance of a comet, visible to the naked eye, has for about a month past excited much attention.

It was seen by Mr. Walker on the 26th of Sept. (vide subjoined letter).

Sept. 28 it was observed by a gentleman at Bath about eight in the evening. It was then near the star in Libra, with about 5° S. declination, and 218 right ascension. On the 30th it was again seen at Bath about the same hour $2\frac{1}{2}$° north of the equator, and $216\frac{1}{2}$ R. A.: the tail about 5° long, and the nucleus distinct and bright. These observations are not given as correct.

On the 30th Sept. it was seen at London, but we have got no observation.

Oct. 2, it was seen in the neighbourhood of the metropolis, as bright nearly as a star of the first magnitude, with a short bushy tail.

A gentleman at Hampstead, who observed it with care, informs us that its place was about 20° from Arcturus, in a line towards Beta Libra.—In Jones's new globe the place was in the centre of Mons Menelaus. It was seen distinctly from 20′ before seven in the evening till low down among the vapours in the western horizon towards nine o'clock.

From Mr. Firminger, late assistant to the royal observatory, we received the following observation made on Tuesday evening, Oct. 6:—at 8^h 17′ 22″ mean time, right ascension 15^h 16′ 4″, declination 7° 23′ 28″, observed by an excellent small equatorial made by the late celebrated Mr. Bird.—The length of the tail, as found by the time of its passage over the meridian wire, extended 50′ of a degree, and its mean breadth measured about 7′.

Oct. 11, at 7^h P. M. the comet was one degree to the east of the star marked Y on Hercules's right shoulder, its declination being nearly 20° north, and right ascension 243°, being 16^h 12′. Sets about half past nine, at 33° to the north of the west; having increased its declination 14°, and

its right ascension 23° degrees, in fifteen days; the sun having passed over 15° of right ascension in the same time, and made 5° of southern declination.

Oct. 12, it was seen, notwithstanding the strong moonlight, in the neck of the Serpent, making nearly an equilateral triangle with Alpha of the Northern Crown and Beta Herculis. The nucleus appeared still pretty bright; but the short tail was much weakened by the force of so much moon-light. In this last interval, it seems to have moved about 10 or 12° more northerly, and towards the east.

Observations made on the Comet in the Neighbourhood of Gosport, Hants:—From different observations and calculations, it appears evident that the comet passed the equator on the 27th of September, about one o'clock P. M., with 218° right ascension; since which the following observations have been made to determine its place and daily motion:

Oct. 2d, at 7 P.M.	Right Ascen. 224°	Dec. 4° N.
6th, at 7 P.M. - - -	228·	Dec. 7° 30′ N.
14th, at 7 P.M. - - -	237	Dec. 15° 00′ N.

In four days it passed over 5° 40′, and in the last eight days 10° 30′ in the arc of a great circle. The weather has in general been cloudy, with fogs, since its first appearance.

To Mr. Tilloch.

SIR, The Manor House, Hayes, Middlesex, October 24, 1807.

I send you a few observations on the present comet, which may be inserted in your valuable Magazine, if you think them worthy a place.

I first saw it on Saturday evening, the 26th of September, when it nearly equalled Arcturus in brightness. This led me to hope I might see it in the day-time with my equatorial instrument; and, after some attention, I readily discerned it at eleven in the morning, but it was by no means so distinct as Arcturus. The nucleus having gradually diminished, I cannot now see it till the sun is set. It had passed its perihelion

helion before it was seen in this country; but, had we been on the look-out a few months ago, in the morning, before the sun rose, we might probably have seen it in its passage towards him. It is now receding almost perpendicularly from the ecliptic, but may probably be visible for near a month longer. By a good observation to-night, comparing it with Beta Herculis (which was in the field of a night glass), it follows that star 5′ 41″ in time, and has 3′ greater north declination.

I have viewed it with a 7-feet Newtonian reflector of 6¼ inches aperture, with magnifying powers from 90 to 500 times; with a Cassegrain telescope of larger size; with an excellent achromatic of Mr. Dollond: but its effect is best by a good night glass magnifying about six or eight times; with this the tail is ascertained to be 1° 40′ long. To-night it passes over a beautiful cluster of small stars, which are not at all affected by the transmission. The tail forms an angle of about 35 or 40° wide, but in the night glass and to the naked eye appears to issue immediately behind the nucleus; but in the above powerful instruments the nucleus appears of a hazy ill-defined roundness, nearly as large as Jupiter; and the vapour appears to surround the head, and then be forced behind.

I herewith send the sketches I made this evening (Plate II.): the first from the night glass, the second from the Newtonian reflector magnifying ninety times.

I am, sir,

Your humble servant,

W. Walker.

The following notice respecting the comet appears in the *Moniteur* of the 8th of October:—"M. Pons, belonging to the observatory at Marseilles, was the first astronomer who discovered the comet in France, on the 20th of last month; and M. de Thuis, of the same establishment, noticed it on the 21st and 22d. From the observations which they communicated to the astronomers at Paris, M. Burckhardt determined the following orbit, which he presented to the class of

of mathematical and philosophical sciences of the National Institute on the 5th of this month: Passage to the perihelion, 25th September, 3 A.M., distance of the perihelion 0·6158; perihelion 291° 4′; nucleus 267° 47′; inclination 48° 4′: movement direct. These hints, says M. Burckhardt, will be sufficient to calculate the route of the comet; but it may be discovered without any trouble, being distinguishable by the naked eye, as soon as night has closed. It is now (September 25th) to the left of Arcturus, between the stars of the Boreal Crown and those of Libra to the west. Its motion is one degree per day towards the north, and rather more than a degree towards the east. This comet was also seen on the 28th at Vezhoul, and M. Flaugergues perceived it on the 26th at Viviers. It seemed to him like a white nebulous spot, very brilliant, and similar to a star of the second magnitude. It was surrounded by a nebulosity of about six minutes in diameter, and had a tail about a degree and a half in length. It is the opinion of the Institute that this comet is different from any with which we are acquainted."

MISCELLANEOUS.

The Institution for the Cure of Impediments of Speech and the Improvement of English Oratory, No. 40, Bedford-place, Russell-square, opened again, after the recess, at the latter end of September; and Mr. and Mrs. Thelwall have announced their intention of continuing the regular courses of instruction in the different departments of elocution, both to private and to house pupils, without interruption, till the ensuing annual recess, in the month of August. The following are the different descriptions of pupils for whose benefit the institution is principally established, (the adults being superintended by Mr. and the junior pupils by Mrs. Thelwall:)—1. Ladies and gentlemen afflicted with impediments, whether from organic defects, or early imitation and habit. 2. Foreigners desirous of instruction in the idiom and pronunciation of the English language. 3. Persons aspiring to the higher accomplishments of elocution, as applicable to the senate, the bar, the pulpit, or the stage. 4. Students who

who wish to cultivate the graces and elegancies of English composition, and a taste for poetry, criticism, and polite literature; or to improve the talent for conversation, and the art of reading with ease and propriety. Classical and mathematical tutors attend on those pupils who require their assistance, and proper teachers for music, dancing, and every other accomplishment; it being the object of the institution, in its present enlarged establishment, not only to remedy all defects of utterance, and initiate youth into the principles and practice of an impressive and graceful elocution, but also to give the last finishing to an accomplished education, and prepare the pupil for the intercourses of polished society and the higher departments of active life. Mr. Thelwall's public lectures commenced on Monday, the 26th of October, and will be continued every Monday evening during the winter season.

M. Bettancourt, chief engineer to his majesty the king of Spain, has communicated to the French Institute a new invention which will render the construction of canals infinitely more easy in future, in-so-far as it provides against all useless expenditure of water. M. A. Pictet, the tribune, who mentioned it in the report made to the legislative body respecting the proposed law for imposing taxes for repairing roads and bridges, &c., gives the following idea of the above improvement:—"Each lock is furnished with an adjoining reservoir, communicating with it at bottom: the lock is destined to raise and lower the vessels as usual, but the vertical movement of the liquid which floats them is produced by the simple immersion or emersion of a box in the contiguous reservoir; the volume of this box is equal to that of the water to be displaced, and it is so happily and ingeniously balanced, that one man is sufficient for raising or lowering the largest vessel. Thus, in future, the more or less considerable supply of water, which formed one of the chief difficulties in the construction of canals, will be reduced to the quantity necessary for supplying the waste by filtration and evaporation."

The

The Russian company for promoting discoveries in the north-west of America has taken possession of the island of Sachin, in the sea of Ochosck. This island, which extends from 45° to 52° of north latitude, has been described by La Peyrouse. M. de Krusenstiern examined it, and determined astronomically different points of it, upon his return from Japan, so that it is now perfectly well laid down. M. de Krusenstiern has made a very minute chart of it. He has also verified what was advanced by La Peyrouse, namely, that there was no passage for shipping between this island and the eastern coast of Tartary. The northern part of the island is inhabited by Tartars, and the south-east part by Japanese.

The Spanish government has presented to the botanists who are occupied in the completion of the Flora of Peru, eleven drawings, perfectly executed and coloured on the spot, of so many new species of Quinquina, which were sent to Spain from Peru, in January last, by don Juan Tafalla and don Juan Mazanilla, both eminent naturalists. It is said that the above are in reality new species, and not simple varieties of the same genus: thus we have now drawings and descriptions of twenty-nine species of Quinquina. Thirty additional new species are still expected, which have been long known to exist in Peru.

The Austrian archduke John, who is much given to the study of natural history, is employed at this time in a grand botanical work, in which he gives a description of a great number of plants hitherto unknown, of which he has found specimens in his travels in the Tyrol, in the country of Saltzbourg, and Lower Austria. Some sheets of this work, which is ornamented with a great many prints, have just appeared; but booksellers are not permitted to sell them. The archduke destines the whole edition for his particular friends, and persons distinguished in the science. The same prince has just purchased the beautiful cabinet of minerals which belonged to professor Jacquin, of Vienna, for 24,000 florins.

METEORO-

METEOROLOGICAL TABLE,
By Mr. Carey, of the Strand,
For October 1807.

Days of the Month.	Thermometer. 8 o'Clock, Morning.	Thermometer. Noon.	Thermometer. 11 o'Clock, Night.	Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
Sept. 27	59°	66°	54°	29·45	25	Fair
28	54	60	47	·71	51	Fair
29	46	56	52	·60	0	Rain
30	56	60	45	·62	41	Fair
Oct. 1	41	56	51	30·19	32	Cloudy
2	56	64	56	·04	44	Fair
3	57	64	57	·12	15	Fair
4	56	64	56	·17	15	Fair
5	56	65	57	·03	16	Fair
6	56	60	56	·03	10	Cloudy
7	57	67	59	·01	38	Fair
8	58	59	50	29·85	39	Cloudy
9	51	59	54	30·15	32	Fair
10	57	64	58	·13	18	Cloudy
11	58	65	57	·10	20	Cloudy
12	57	64	58	·02	17	Cloudy
13	58	65	59	·22	19	Cloudy
14	59	66	59	·20	21	Fair
15	59	65	55	·06	5	Cloudy
16	50	62	52	·13	22	Cloudy
17	53	62	56	·01	18	Cloudy
18	59	59	48	·02	23	Fair
19	42	58	52	·25	26	Fair
20	51	64	55	29·89	29	Fair
21	55	63	54	·46	20	Fair
22	52	56	50	·31	0	Rain
23	46	51	41	·24	14	Cloudy
24	38	53	46	·36	10	Showery
25	47	55	50	·65	17	Fair
26	51	55	44	·62	10	Cloudy

N.B. The Barometer's height is taken at one o'clock.

XVI. *Proposal for a new System of Building Houses, Streets, &c. By* G. Field, *Esq.*

To Mr. Tilloch.

SIR,

The analogy between the following essay and an ingenious paper which I have lately seen "On the Figure in which Trees should be disposed in Plantations," (quoted in No. 7 of the Retrospect, from the Farmer's Magazine, No. 28,) and their dependance on the same principles, have induced me to resume my essay, which is connected with a more extensive design, and has lain-by several years, and to publish it through your Magazine, with which I consider it more compatible than with either of the above.

The author of the paper I have mentioned has demonstrated that the most advantageous distribution of trees in a plantation is hexangular, because he has observed in nature "*that mature strong trees, which have arisen from the seed of any one tree, will be found nearly in the angles of an equilateral and equiangular hexagon, with the original tree in the centre;*" and because "*the closest order in which it is possible to place a number of points upon a plane surface, not nearer than a given distance from each other, is the angles of hexagons, with a point in the centre of each hexagon.*" (See Euclid, book iv. prop. 15.)

In nature it may be observed also *that the general form of trees is circular, their branches diverging in radii from their trunks as centres, and that nature distributes their offspring in circles around the parent trees.* It may be also rationally or mathematically proved *that the closest arrangement of circles on a plane is in hexagons*; and these are the points of union and coincidence by which an easy transition is made from the subject of the above paper to that of the present essay; coincidences arrived at, probably, by very different routes, and strongly presumptive of the same foundation in nature and truth.

On the general Application of the circular Form in Architecture.

" Order is Heav'n's first law."

Pope's Essay on Man.

It is notorious that the rough proportion of the diameter to the circumference of a circle is as 7 to 22, rather exceeding 1 to 3. If, therefore, we draw a line AB (fig. 5. Pl. III.) three times the length of the diameter of a circle C, allowing $\frac{1}{22}$ diameter for deficiency, and divide this line into four equal parts, we have the measure of the four sides of a square D, equal to the circumference of the circle C.

It is evident, therefore, that *the circle circumscribes a much greater area than the square, at the same time that its extremities lie nearer together*; that therefore the circle is of the two the most eligible form for a building in general; and that, whatever be the materials used for erecting the walls, less of them will be required for a circular than for a square edifice of equal dimensions; consequently, a considerable saving of materials.

To these may be added the following considerations and advantages depending on the general properties of the circle:

That of all forms of building, the circular is the most simple, the most durable, and the strongest.

That for beauty and sublimity it is far superior to other forms, presenting one endless front (whatever is bounded being little to the imagination, the power of which is infinite); and it is susceptible of all the variety of architectural decorations in arcades, colonnades, domes, porticos, &c.

That the view from a circular edifice is much more extensive than from a square building, no angles intercepting the sight from the windows, &c., while the light entering laterally at the windows, enlivens the dark piers between them.

That structures of this form may be raised upon the principle

ciple of the *cask*, and the materials formed into girders or *hoops* resting on each other, so as to render it impossible either to force its walls in or out; and hence the greatest strength with the least consumption of materials.

That as *hoops* may be formed of the materials to connect the parts of a building with firmness, so, to apply the idea of the cask further, *staves* may be framed of wood or other materials (fig. 2.), to be connected by hoops or bolts, and the openings, except such as may be required for doors and windows, may be pannelled, plastered, or bricked up.

Thus, large structures of great strength, durability, and lightness (and portable buildings), may be framed at the least expense, for barns, manufactories, &c., while the face of the country would be rendered extremely picturesque and beautiful thereby, covered, as it were, with temples.

That the natural form of covering or roof for a circular building is the *dome*, which may also be constructed on the principle of the cask to any extent, or of hoops or rings diminishing upwards and resting on each other, extremely light, durable, and strong.

That the dome is the best form of roof for resisting all kinds of weather, requiring no other support than it has intrinsically; and hence it is a hollow structure affording space for rooms which in other roofs is occupied by timbers, and therefore requires less materials, while the dome is acknowledged to be both externally and internally extremely beautiful; the only form of roof, perhaps, that is so; whence other roofs have been purposely hidden by the walls, giving to edifices the appearance of mere inclosures.

That the distribution of the timbers of the floors according to fig. 3. would save timber and give great stiffness and solidity to the floors, as the shorter timbers would require a proportionably less diameter, and the divisions of the house into apartments may rest upon and support the timbers. Or, if required, the floors may be more strongly and flatly vaulted with masonry than in other forms of building, owing to the power of supporting lateral pressure in walls built upon the principle I have suggested; and the ceilings might be

formed into shells, fans, &c., providing at once safeness from fire, durability, strength, and beauty.

That the stairs may be disposed with great advantage in the centre of the building (fig. 1. F), affording the readiest communication to all parts of the house, lighted from the top of the dome by a lantern of the most simple or beautiful form; while the well, spiral, or circular staircase is confessedly the most beautiful and the strongest. In these latter particulars, however, there is the greatest latitude for variation to which fancy, convenience, or even prejudice, may prompt: nor is it necessary in a mere sketch to show how the apartments may be laid out, the stairs and passages disposed, the fireplaces and chimneys arranged, ventilation carried on, or water conducted, &c. throughout this form of building; suffice it that it is susceptible of all the variation of other buildings in these respects, and with some peculiar advantages, as might be shown were I intent upon entering minutely into the subject.

Such are the advantages of this form in individual buildings; such as are unequalled in general by other forms for strength, beauty, and convenience.

Nor are the advantages of this form confined to the individual structure, but extend to general and even universal use; analogous to other cases physical, moral, and political, in which that which benefits the individual is also good for the many.

First, then, as to its general use, a circle of circular houses (fig. 4.) has the following advantages:

That this arrangement of buildings, in common with the individual, is stronger than any other.

That, as there are certain proportions of height to the diameter in individual structures which best satisfy the demands of taste, and are called harmonic, and as in towns and cities the value of horizontal space is such as to occasion houses to be built much higher than those which stand detached in the country, so the diameter of these circles would enable us to carry the individual houses to a great height with much solidity, agreeably to these demands of taste, in one uniform

uniform design susceptible of great variety, beauty, and grandeur; the interior forming one magnificent amphitheatre.

That each house of the circle, touching only in a point, would require no party walls (Euclid, book iii. prop. 13), yet would be more secure from fire, as engines, &c. could reach a much greater surface of each edifice than in lines or streets of square-formed houses.

That each house would be better lighted and ventilated than in any other arrangement, and would have a better and more extensive view and front, advantageous to the trading part of the community, and agreeable to all.

That as the purpose for which men assemble in towns and cities is social intercourse in business and pleasure, so of all forms in which dwellings can be arranged for the purposes of *society*, that here pointed out is not only the strongest, most commodious, œconomical, and beautiful, but also the least *solitary*; each house being within sight and communication with every other of the circle, at the same time that privacy and distinctness are sufficiently provided for.

That a building or buildings around a circular court or mews in the centre, may become the offices, stabling, &c. of each house, and one common receptacle and sewer may receive and carry off the filth from the drains of each house, and these at a point the furthest distance from each, the sewer running under the passage by which the court or mews communicates with the exterior of the rotundo, so to call this circular arrangement of houses; while, on the other hand, water may be supplied very œconomically either this way or externally to each house.

Without entering minutely into the arrangement of circular houses in other forms, I shall merely mention, that, with many of the foregoing advantages, they may be distributed in rows, streets, or squares, the angles of which would be all rounded off, and the same of gateways, &c., and the beauty of which may be easily imagined.

Finally, this form is capable of universal application in the distribution of cities, with the individual and general

advantages already pointed out, together with utilities of a more extensive nature, as follows, demonstrable by fig. 5, in which these circles of circular houses are arrangeable in circles of a higher order to infinity.

It is evident, then, by inspecting the diagram, without resorting to abstract principles, that from every circle thereof there is a straight road to every other circle of this city: hence the quickest possible intercourse and uninterrupted communication with its most extreme parts; hence public drains and water-courses, lighting and watching, &c. may be conducted upon the most efficacious and œconomical plan possible, advantageous to the individual and community; and hence the freest circulation of air, health, and order, there being no place close or obstructed—no lanes, courts, and alleys, scenes of filth, disease, and immorality.

As to public buildings, such as palaces and offices of government, colleges, churches, and almshouses, theatres, prisons, forts, &c., the first might occupy a grand circle in the centre of the city, of a proportion and magnificence worthy of the whole; the rest might be distributed in other parts of the city, according to their nature and convenience; and it might be shown, and may be easily conceived from what precedes, in what manner the circular form is best of all adapted to their respective purposes: in fine, it were an offence to common sense to extend this description to the further uses and variations of this plan.

On the other hand, I am aware of the opposition which may be urged against it by long established prejudice to the square form; the adaption of habits, tools, materials, and instruments, to this latter form, by which circular work is attended with difficulty and expense in nowise natural to it; the outcry for picturesque beauty and variety where mechanical beauty, viz. simplicity and uniformity, only should be demanded by true taste; yet the charge of sameness is more applicable to the lineal form of streets and squares, while this plan is susceptible, without disturbing it, of variations in the dimensions and ornaments of its buildings suited

suited to the various classes and ranks of society; and the beauty, variety, change, and infinite extent of view, either standing or moving, in such a city, may easily be imagined: but as this plan is *general*, and all objections that may be brought against it are likely to be *particular*, they cannot legitimately oppose it.

To end, then, at the point of coincidence from which I departed, the distribution of this city is into hexagons, according with the natural arrangement of the forest pointed out by the author of the ingenious paper I have quoted; to which may be added, that the circle is the form indicated by nature, and instinctively followed by inferior animals in the construction of their habitations, and in the huts of infant societies, as those of the Caffres, who observe this form not only in their individual habitations, but also in their kralls or villages.

Thus I have described the individual, species, and genus of my plan, advancing from the lowest to the highest; and lest some readers should conclude that I am, like certain modern politicians, so giddied by turning in a circle and disposed to whirl all things together in my vortex, or, in other terms, so blinded by a system as to recommend seriously the universal adoption of a perfectly uniform plan, to the exclusion of long established customs adapted to the disunited and imperfect state of man, I must declare, ere I take my leave, that the purpose of this essay is merely to sketch a speculative model for the excitement of thought, and from which the artist is at liberty to select, to reject altogether, to recompose, or vary to his purposes.

G. Field.

XVII. *On the Œconomy of Bees. In a Letter from* Thomas Andrew Knight, *Esq. F. R. S. to the Right Honourable Sir* Joseph Banks, *Bart., K.B. P.R.S.**

MY DEAR SIR,

In the prosecution of those experiments on trees, accounts of which you have so often done me the honour to present to the Royal Society, my residence has necessarily been almost wholly confined to the same spot, and I have thence been induced to pay considerable attention to the œconomy of bees amongst other objects; and as some interesting circumstances in the habit of these singular insects appear to have come under my observation, and to have escaped the notice of former writers, I take the liberty to communicate my observations to you.

It is, I believe, generally supposed that each hive, or swarm, of these insects remains at all times wholly unconnected with other colonies in the vicinity; and that the bee never distinguishes a stranger from an enemy. The circumstances which I shall proceed to state, will, however, tend to prove that these opinions are not well founded, and that a friendly intercourse not unfrequently takes place between different colonies, and is productive of very important consequences in their political œconomy.

Passing through one of my orchards rather late in the evening in the month of August, in the year 1801, I observed that several bees passed me in a direct line from the hives in my own garden to those in the garden of a cottager, which was about a hundred yards distant from it. As it was considerably later in the evening than the time when bees usually cease to labour, I concluded that something more than ordinary was going forward. Going first to my own garden, and then to that of the cottager, I found a very considerable degree of bustle and agitation to prevail in one hive in each: every bee, as it arrived, seemed to be stopt and questioned at the mouth of each hive; but I could not discover any thing like actual resistance, or hostility, to take

* From the *Transactions of the Royal Society*, part ii. for 1807.

place;

place; though I was much inclined to believe the intercourse between the hives to be hostile and predatory. The same kind of intercourse continued, in a greater or less degree, during eight succeeding days; and, though I watched them very closely, nothing occurred to induce me to suppose that their intercourse was not of an amicable kind. On the tenth morning, however, their friendship ended, as sudden and violent friendships often do, in a quarrel; and they fought most furiously; and after this there was no more visiting.

Two years subsequent to this period I observed the same kind of intercourse to take place between two hives of my own bees, which were situated about two hundred yards distant from each other: they passed from each hive to the other just as they did in the preceding instance, and a similar degree of agitation was observable. In this instance, however, their friendship appeared to be of much shorter duration, for they fought most desperately on the fifth day, and then, as in the last mentioned case, all further visiting ceased.

I have some reason to believe that the kind of intercourse I have described, which I have often seen, and which is by no means uncommon, not unfrequently ends in a junction of the two swarms; for one instance came under my observation, many years ago, in which the labouring bees, under circumstances perfectly similar to those I have described, wholly disappeared, leaving the drones in peaceable possession of the hive, but without any thing to live upon. I have also reasons for believing, that whenever a junction of two swarms, with their property, is agreed upon, that which proposes to remove, immediately, or soon afterwards, unites with the other swarm, and returns to the deserted hive during the day only to carry off the honey; for, having examined at night a hive from which I suspected the bees to be migrating, I found it without a single inhabitant. I was led to make the examination by information I had received, from a very accurate observer, that all the bees would then be absent. A very considerable quantity of honey was in this instance left in the hive, without any guards to defend

it; but I conclude that the bees would have returned for it, had it remained till the next day. Whenever the bees quit their habitation in this way, I have always observed some fighting to take place; but I conceived it to be between the bees of the adjoining hives and those which were removing, the former being attracted by the scent of the honey which the latter were carrying off.

On the farm which I occupy there were formerly many old decayed trees, the cavities of which were frequently occupied by swarms of bees; and when these were destroyed, a board was generally fitted to the aperture which had been made to extract the honey; and the cavity was thus prepared for the reception of another swarm in the succeeding season. Whenever a swarm came, I constantly observed that about fourteen days previous to their arrival a small number of bees, varying from twenty to fifty, were every day employed in examining, and apparently keeping possession of, the cavity; for, if molested, they showed evident signs of displeasure, though they never employed their stings in defending their proposed habitation. Their examination was not confined to the cavity, but extended to the external parts of the tree above; and every dead knot particularly arrested their attention; as if they had been apprehensive of being injured by moisture which this might admit into the cavity below; and they apparently did not leave any part of the bark near the cavity unexamined. A part of the colony which purposed to emigrate, appeared in this case to have been delegated to search for a proper habitation; and the individual who succeeded must have apparently had some means of conveying information of his success to others; for it cannot be supposed that fifty bees should each accidentally meet at, and fix upon, the same cavity, at a mile distant from their hive; which I have frequently observed them to do, in a wood where several trees were adapted for their reception; and indeed I observed that they almost uniformly selected that cavity which I thought best adapted to their use.

It not unfrequently happened that swarms of my own bees took possession of these cavities, and such swarms were in several instances followed from my garden to the trees;

trees: and they were observed to deviate very little from the direct line between the one point and the other; which seems to indicate that those bees which had formerly acted as purveyors, now became guides.

Two instances came under my own observation, in which a swarm was received into a cavity of which another swarm had previous possession. In the first instance I arrived with the swarm, and I could not discover that the least opposition was made to their entrance: in the second instance, observing the direction that the swarm took, I used all the expedition I could to arrive first at the tree to which I supposed they were going, whilst a servant followed them; and a descent of ground being in my favour, and the wind against them, I succeeded in arriving at the tree some seconds before them; and I am perfectly confident that not the least resistance was opposed to their entrance.

Now it does not appear probable that animals so much attached to their property as bees are, so jealous of all approach towards it, and so ready to sacrifice their lives in defence of it, should suffer a colony of strangers, with whose intentions they were unacquainted, to take possession, without making some effort to defend it: nor does it seem much more probable that the same animals, which spent so much time in examining their future habitation, in the cases I have mentioned, should have attempted in this case to enter without knowing whether there was space sufficient to contain them, and without any examination at all. I must therefore infer that some previous intercourse had taken place between the two swarms, and that those in the possession of the cavities were not unacquainted with the intentions of their guests; though the formation of any thing like an agreement between the different parties be scarcely consistent with the limitations generally supposed to be fixed by nature to the instinctive powers of the brute creation.

Brutes have evidently language; but it is a language of passion only, and not of ideas. They express to each other sentiments of love, of fear, and of anger; but they appear to be wholly incapable of transmitting to each other any ideas they have received from the impression of external objects.

jects. They convey to other animals of their species, on the approach of an enemy, a sentiment of danger; but they appear wholly incapable of communicating what the enemy is, or the kind of danger apprehended. A language of more extensive use seems, from the preceding circumstances, to have been given to bees; and if it be not, in some degree, a language of ideas, it appears to be something very similar.

When a swarm of bees issue from the parent hive, they generally soon settle on some neighbouring bush or tree; and as in this situation they are generally not at all defended from rain or cold, it is often inferred that they are less amply gifted with those instinctive powers that direct to self-preservation than many other animals. But their object in settling soon after they leave the hive, is apparently nothing more than to collect their numbers; and they have generally, I believe always, another place to which they intend subsequently to go; and if the situation they select be not perfectly adapted to secure them from injuries, it is probably, in almost all instances, the best they can discover. For I have very often observed that when one of my hives was nearly ready to swarm, one of the hollow trees I have mentioned (and generally that best adapted for the accommodation of a swarm) was every day occupied by a small number of bees, but that after the swarm had issued from that hive, and had taken possession of another, the tree was wholly deserted; whence I inferred that the swarm, which would have taken possession of the cavity of that tree, had relinquished their intended migration when a hive was offered them at home. And I am much disposed to doubt whether it be not rather habit, produced by domestication, during many successive generations, than any thing inherent in the nature of bees, which induces them to accept a hive, when offered them, in preference to the situation they have previously chosen: for I have noticed the disposition to migrate to exist in a much greater degree in some families of bees than in others; and the offspring of domesticated animals inherit, in a very remarkable manner, the acquired habits of their parents. In all animals this is observable; but in the dog it exists to a wonderful extent, and the offspring appears

appears to inherit not only the passions and propensities, but even the resentments, of the family from which it springs. I ascertained, by repeated experiment, that a terrier, whose parents had been in the habit of fighting with polecats, will instantly show every mark of anger when he first perceives the scent of that animal, though the animal itself be wholly concealed from his sight. A young spaniel brought up with the terriers showed no marks whatever of emotion at the scent of the polecat; but it pursued a woodcock, the first time it saw one, with clamour and exultation: and a young pointer, which I am certain had never seen a partridge, stood trembling with anxiety, its eyes fixed and its muscles rigid, when conducted into the midst of a covey of those birds. Yet each of these dogs are mere varieties of the same species; and to that species none of these habits are given by nature. The peculiarities of character can therefore be traced to no other source than the acquired habits of the parents, which are inherited by the offspring, and become what I shall call instinctive hereditary propensities. These propensities, or modifications of the natural instinctive powers of animals, are capable of endless variation and change; and hence their habits soon become adapted to different countries and different states of domestication, the acquired habits of the parents being transferred hereditarily to the offspring. Bees, like other animals, are probably susceptible of these changes of habit; and thence, when accustomed through many generations to the hive, in a country which does not afford hollow trees, or other habitations adapted to their purpose, they may become more dependent on man, and rely on his care wholly for an habitation; but in situations where the cavities of trees present to them the means of providing for themselves, I have found that they will discover such trees in the closest recesses of the woods, and at an extraordinary distance from their hives; and that they will keep possession of such cavities in the manner I have stated: and I am confident that, under such circumstances, a swarm never issues from the parent hive without having previously selected some such place to retire to.

It has been remarked by Mr. John Hunter, that the matter which bees carry on their thighs is the farina of plants with which they feed their young, and not the substance with which they make their combs; and his statement is, I believe, perfectly correct: but I have observed that they will also carry other things on their thighs. I frequently covered the decorticated parts of trees, on which I was making experiments, with a cement composed of bees-wax and turpentine; and in the autumn I have frequently observed a great number of bees employed in carrying off this substance. They detached it from the tree with their forceps, and the little portion thus obtained was then transferred by the first to the second leg, by which it was deposited on the thigh of the third: the farina of plants is collected and transferred in the same manner. This mixture of wax and turpentine did not, however, appear to have been employed in the formation of combs; but only to attach the hive to the board on which it was placed, and probably to exclude other insects, and air during winter. Whilst the bees were employed in the collection of this substance, I had many opportunities of observing the peaceful and patient disposition of them as individuals, which Mr. Hunter has also, in some measure, noticed. When one bee had collected its load, and was just prepared to take flight, another often came behind it, and despoiled it of all it had collected. A second, and even a third load was collected, and lost in the same manner, and still the patient insect pursued its labour without betraying any symptoms of impatience or resentment. When, however, the hive is approached, the bee appears often to be the most irritable of all animals; but a circumstance I have observed amongst another species of insects, whose habits are in many respects similar to those of bees, induces me to believe that the readiness of the bees to attack those who approach their hives, does not in any degree spring either from the sense of injury or apprehensions of the individual who makes the attack. If a nest of wasps be approached without alarming its inhabitants, and all communication be suddenly cut off between those out of the nest, and those within it, no provocation will induce the former

former to defend their nest or themselves: but if one escape from within, it comes with a very different temper, and appears commissioned to avenge public wrongs, and prepared to sacrifice its life in the execution of its orders. I discovered the circumstance, that wasps thus excluded from their nest, would neither defend it, nor themselves, at a very early period of my life; and I profited so often by the discovery, as a schoolboy, that I am quite certain of the fact I state; and I do not entertain any doubt, though I speak from experiments less accurately made, that the actions of bees, under similar circumstances, would be the same*.

Mr. Hunter conceived bees wax to be an animal substance, which exuded between the scales of the belly of the insect: but I am strongly disposed to believe that it is collected from plants, and merely deposited between the scales of the belly of the bee, for the joint purposes of being carried with convenience, and giving the temperature necessary for being moulded into combs: and I am led to this conclusion, not only by the circumstance of wax being found in the vegetable world, but also by having often observed bees employed in detaching something from the bases of the leaves of plants with their forceps, which they did not deposit on

* A curious circumstance relative to wasps attracted the notice of some of my friends last year, and has not, I believe, been satisfactorily accounted for. A greater number of female wasps were observed in different parts of the kingdom, in the spring and early part of the summer of that year, than at almost any former period; yet scarcely any nests, or labouring wasps, were seen in the following autumn; the cause of which I believe I can explain. Attending to some peach-trees in my garden, late in the autumn of the year 1805, on which I had been making experiments, I noticed, during many successive days, a vast number of female wasps, which appeared to have been attracted there by the shelter and warmth of a south wall; but I did not observe any males. At length, during a warm gleam in the middle of one of the days, a single male appeared, and selected a female close to me; and this was the only male I saw in that season. The male wasp, which is readily distinguishable from the female and labourer, by his long antennæ and shining wings, and by a blacker and more slender body, is rarely seen out of the nest, except in very warm days, like the drone bee; and the nests of wasps, though very abundant in the year 1805, were not formed till remarkably late in the season; and thence I conclude that the males had not acquired maturity till the weather had ceased to be warm, and that the females, in consequence, retired to their long winter sleep without having had any intercourse with them.

their

their thighs, as they do (I believe invariably) the farina of plants. I have also frequently observed the combs of very late swarms to be remarkably thin and white, and brittle; which are circumstances very favourable to the conclusion that the wax is a vegetable substance, for it would probably be less abundant during autumn than in summer; and that portion which had remained on the plants till late in the season would hence become more colourless by exposure to light, as well as more dry and brittle, than when at first exuded; but were it an animal substance, there does not appear any reason why it should be more dry and brittle, or less abundant, in the autumn than in the spring and summer. The conclusions of Mr. Hunter are, however, always drawn with so much caution, and he united so much skill and science with the greatest degree of industry, that it is not without much hesitation and diffidence that I venture to put my opinion in opposition to his authority.

T. A. KNIGHT.

Elton,
May 4, 1807.

XVIII. *Note upon a fulminating Combination of Silver, of a white Colour and a crystalline Appearance. By M.* DESCOSTILS*.

THERE is sold at Paris, as an object of amusement, a detonating powder inclosed in slips of cards cut lengthways. The powder is placed at one end of this carcase, and the other end is made smaller in order to be more easily distinguished. If this last extremity is seized with one hand, and the other end is held over the flame of a candle, a detonation speedily takes place, with a sharp noise and a violet-coloured flame; the card is torn to pieces and scorched, and the part which the composition touched is covered with a slight metallic coating of a grayish white.

Having been consulted upon the nature of this substance, which is sent ready prepared to Paris, I was convinced, after

* From *Annales de Chimie*, tom. lxii. p. 199.

various

various experiments, which it is needless to detail, that it is a combination of oxide of silver, ammonia, and a vegetable substance; a combination analogous, as we find, to that which constitutes the fulminating mercury of Mr. Howard.

We may obtain this combination, which I shall call *detonating silver*, to distinguish it from the *fulminating silver* of M. Berthollet, by dissolving silver in pure nitric acid, and by pouring into the solution, while it is effecting, a sufficient quantity of rectified alcohol, or by pouring the alcohol into a nitric solution of silver, with a considerable excess of acid.

In the first case we must slightly warm the nitric acid in which the silver has been put, until the solution begins to take place, *i. e.* until the first bubbles begin to be perceived. We must then remove it from the fire and immediately add a sufficiency of alcohol, so that no nitrous vapours may be liberated. The mixture of the two liquors takes place with a disengagement of heat; the effervescence immediately recommences, without disengagement of nitrous gas; it gradually increases, and there is liberated at the same time a strong smell of nitrous ether. The liquor soon becomes turbid, and we see deposited a white crystalline and very dull powder, which must be separated, when it ceases to fall down, and washed several times with small quantities of water.

When we employ the solution of silver ready made and strongly acid, we must heat it slightly and afterwards add the alcohol; the heat produced by the mixture, which gradually takes place, soon determines a considerable ebullition, and the powder is suddenly deposited *.

This powder has the following properties:

It is white and crystalline; but this last appearance is variable with respect to the volume and the lustre of the crystals.

It changes a little in the light. It inflames with a sharp detonation by heat, agitation, or long continued friction.

* It is almost needless to observe, that the mixture of alcohol and warm nitric acid is subject to many accidents, and we must consequently operate upon very small quantities.

Simple pressure, provided it be not very strong, produced no change.

It detonates upon being struck by the electrical spark.

It is slightly soluble in water. It has an extremely strong metallic taste.

Concentrated sulphuric acid determines its inflammation, and the acid itself is driven to a great distance: dilute sulphuric acid seems to decompose it slowly.

Weak or concentrated muriatic acid decomposes it instantly, by forming muriate of silver. The quantity of muriate obtained indicates about 71 per cent. of metallic silver in the detonating silver; at first there is liberated a very decided smell of prussic acid, but I could not collect any sensible traces of it.

The nitric acid decomposes it with the assistance of ebullition; and we obtain nothing but nitrate of silver, and nitrate of ammonia, if it be long enough continued.

It is decomposed by means of sulphuretted hydrogen; the ammonia and the vegetable matter remain in the liquor.

Caustic potash decomposes it; black oxide of silver is separated, and ammonia is disengaged.

It is dissolved in ammonia; but by a slow evaporation it is separated from it with its proper colour and other properties, and particularly that of detonating by means of heat, and not by simple contact.

Finally, its property of most importance to consider, is the action it has upon the animal œconomy. M. Pajot-la-Forêt, who has made a great number of experiments upon this subject, is convinced that very small doses are sufficient to kill the strongest animals: when tried upon some cats, all of them expired in the most horrible convulsions. It is in short, without exception, one of the most violent poisons with which the metallic combinations present us.

XIX. *Observations and Measurements of the Planet Vesta. By* John Jerome Schroeter, *F. R. S. Translated from the German* *.

At our very first observations with magnifying powers of 150 and 300, applied to the excellent new 15-feet reflector, we found the planet Vesta without any appearance of a disc, merely as a point like a fixed star, with an intense, radiating light, and exactly of the same appearance as that of any fixed star of the sixth magnitude. In the same manner we both afterwards saw this planet several times with our naked eyes, when the sky was clear, and when it was surrounded by smaller invisible stars, which precluded all possibility of mistaking it for another. This proves how very like the intense light of this planet is to that of a fixed star.

As the observations and measurements of Ceres, Pallas, and Juno, were made with the same eye-glasses, but with the 13-feet reflector, we soon after compared the planet Vesta with the same glasses of 136 and 288 times magnifying power in the 13-feet reflector. In both these telescopes its image was, without the least difference, that of a fixed star of the sixth magnitude, with an intense radiating light; so that this new planet may with the greatest propriety be called an *asteroid*.

April 26th in the evening, at nine o'clock, true time, I succeeded in effecting the measurement of Vesta, with the same power of 288, by means of the 13-feet reflector, with which that of Ceres, Pallas, and Juno, had been made; and when viewed by this reflector it also appeared exactly in the same manner. Of several illuminated discs, of 2·0 to 0·5 decimal lines, which I had before made use of for measuring the satellites of Saturn and Jupiter, the smallest disc only of 0·5 lines could be used for this purpose; by it the rounded nucleus of the planet Vesta, when the disc was at the distance of 611·0 lines from the eye, appeared at most of the same size, and I must even estimate its diameter as one-sixth smaller. If, therefore, we attend not to the full mag-

* From *Transactions of the Royal Society*, part ii. for 1807.

nitude of the projection, but the estimation just mentioned, it follows, by calculation, that the apparent diameter of the planet Vesta is only 0·488 seconds, and consequently only half of what I have found to be the apparent diameter of the fourth satellite of Saturn.

This extraordinary smallness, with such an intense, radiant, and unsteady light of a fixed star, is the more remarkable, as, according to the preliminary calculations of Dr. Gauss, there can be no doubt that this planet is found in the same region between Mars and Jupiter, in which Ceres, Pallas, and Juno, perform their revolutions round the sun; that, in close union with them, it has the same cosmological origin; and that, as a planet of such smallness, and of so very intense light, it is comparatively near to the earth. This remarkable circumstance will no doubt be productive of important cosmological observations, as soon as the elements of the new planet have been sufficiently determined, and its distance from the earth ascertained by calculation.

Lilienthal,
May 12, 1807.

XX. *A new Eudiometer, accompanied with Experiments elucidating its Application. By* William Hasledine Pepys, *Esq.**

The important part which atmospheric air performs in maintaining the principle of life in animals, in combustion of every description, the acidification and oxidation of a great variety of substances, and in numerous other processes both of nature and art, gives a high degree of interest to every thing calculated to extend our knowledge of its nature and properties.

The evidence furnished by modern chemistry of the existence of many other aëriform substances increases this interest, especially when it is considered that, owing to their possessing some of the most obvious properties of atmo-

* From *Transactions of the Royal Society*, part ii. for 1807.

spheric

spheric air, as transparency, elasticity, and a power of great expansion on being exposed to an increase of temperature, they were, with very few exceptions, till lately, confounded either with common air, or not even suspected to exist.

When to these considerations we add the facility with which some products, especially the gaseous, are evolved, in circumstances under which, in the present state of our knowledge, we should hardly look for them; the power they possess of decomposing each other, and by an interchange and new arrangement of principles, of producing compounds possessing properties altogether different from those of the ingredients supposed to be present; and the facilities which every new detection of unsuspected principles affords towards the discovery of others, and consequently the composition or analysis of bodies before held to be simple, it will not appear a matter of surprise that the subject of eudiometry should have obtained a considerable degree of attention from modern philosophers.

This would be an improper place to enumerate all that has been done or proposed by different men of eminence towards the production of something like a perfect system on this important subject; yet some allusion to their labours appears to be indispensable, and will be the means of preventing some circumlocution in our further progress.

Hales* appears to be the first who observed absorption to take place in common air, on mixing it with air obtained from a mixture of Walton pyrites and spirits of nitre; and that in this process from being clear they became "a reddish turbid fume."

Dr. Priestley, as he informs us in his "Observations on different Kinds of Air†," was much struck with this experiment, but never expected to have the satisfaction of seeing this remarkable appearance, supposing it to be peculiar to the Walton pyrites; till encouraged by a suggestion of Mr. Cavendish, that probably the red appearance of the mixture depended upon the spirits of nitre only, he tried solutions of the different metals in that acid, and, catching the air

* Statical Essays, vol. i. p. 224; vol. ii. p. 230.

† Phil. Trans. for 1772, p. 210.

which was generated, obtained what he wished. To the air thus produced he gave the name of *nitrous* air, and, from its possessing the properties of absorbing that portion of atmospheric air which he calls *dephlogisticated*, first proposed its being used as a test for ascertaining the purity of air. His method of proceeding was ingenious and simple; known quantities of the air to be tried, and of nitrous gas, being mixed, were admitted, after the diminution of volume occasioned by their union, into a graduated tube, which he denominated a *eudiometer*.

It was with the test of nitrous gas that Mr. Cavendish* made his masterly analysis of the air at Kensington and London; and by many laborious processes and comparative trials, obtained results, the accuracy of which has been more distinctly perceived the more the science of chemistry has advanced.

The slow combustion of phosphorus, which unites with the oxygen to form an acid, and the decomposition of the fluid sulphuret of potash, are certain methods of separating combinations consisting of oxygen and azote; but the decomposition is effected so slowly by the action of these substances, that it became a desirable object to discover some means for accelerating the process. This was supposed to have been effected by Guyton, who proposed heating the sulphuret of potash; in doing this, sulphurated hydrogen gas, however, is frequently evolved, which, mixing with the residual gas, increases its quantity, and renders the result fallacious.

The green sulphate of iron impregnated with nitrous gas, first discovered by Dr. Priestley, and recently used by Mr. Davy for eudiometrical purposes, from its possessing the property of absorbing oxygen gas from the atmosphere, is much to be preferred to the method with nitrous gas, as the green sulphate of iron does not combine with the other gases with which the nitrous gas is commonly found to be contaminated, and more certain results are obtained.

Having had occasion to repeat many of the experiments

* Phil. Trans. for 1783.

of

of others, and to make some new ones, I soon found what every one who has been engaged on the same subject must have experienced—that an apparatus more commodious than has yet been proposed, and at the same time capable of giving correct results, with the greatest minuteness, was still a desideratum in eudiometry. To detail the various ideas that presented themselves on the subject, would be an unnecessary encroachment on the time of this society; but as I at last succeeded in contriving an instrument possessing the above properties in a very eminent degree, I flatter myself I shall not be thought intrusive in offering a description of it.

This apparatus, (Plate IV.) which is of easy construction, and extremely portable, consists of a glass measure M, fig. 1, graduated into hundred parts; a small gum-elastic bottle, B, fig. 2, capable of containing about twice the quantity of the measure, and furnished with a perforated glass stopper, S, which is well secured in the neck of it by means of waxed thread wound tight round it; and a glass tube, T, fig. 3, also graduated, but into tenths of the formed divisions, or into thousand parts of the measure.

The glass stopper, made fast in the neck of the gum-elastic bottle, as above mentioned, has its exterior end ground with emery, exactly to fit the mouth of the measure; to the lower end of the graduated tube T, is cemented a small steel cock, which is secured into the neck of a very small gum-elastic bottle by means of waxed thread, SB, fig. 4: the other end of the tube is conical, so as to present a very small orifice.

Besides this, the apparatus is furnished with a kind of moveable cistern C, in which the tube can be slid easily up and down, and yet in such a manner that the water or other liquid in the cistern may not pass. This is easily accomplished by means of a cork fitted into its mouth with a perforation through its axis to receive the tube. The cistern, when in use, is to be filled with water or mercury, as the experiment may require, and becomes a secondary cistern for the measure, as will be more clearly understood by the following description of the method of performing experiments with this instrument.

The measure is filled with the air or gas, over mercury, in the usual manner, and the elastic bottle is charged with the solution intended to be employed as the re-agent; the orifice of the stopper is then inserted into the mouth of the measure in the mercury, and pressed home to its place.

The bottle and measure being thus united, are to be firmly held at the joint. Upon pressing the former, a portion of the fluid is injected into the latter, and the gas suffers a degree of compression, by which the action of the affinity between it and the fluid is accelerated. On taking off the pressure, the bottle, by its elasticity, endeavours to obtain its original form, and receives back the fluid. This process should be continued as long as any absorption is observed to take place. When absorption ceases, the bottle is to be separated from the measure under mercury, and the quicksilver which remains in the measure being brought to the level of that in the cistern, the quantity of absorption is then to be determined, which is done as follows:

Suppose atmospheric air has been the subject of the experiment, and consequently a large residuum left; first note the hundred parts, and then to obtain a knowledge of the fractional parts, remove the measure into the small cistern in which the graduated tube filled with mercury is placed: slide the tube above the surface of the fluid in the measure, and, opening the stop-cock, suffer the mercury to descend till it has drawn the fluid in the measure to a regular division; then stop the cock, and register the hundred parts on the measure, and the thousand parts on the graduated tube; the united quantities give the sum of the residual gas. Observe well in registering the thousand parts, that the fluids are exactly on a level on the outside and inside of the measure; this may be easily effected by pouring out a portion of the liquid of the small cistern, or adding thereto.

If instead of atmospheric air, a gas is tried, which, so far as it is uncontaminated, can be nearly wholly absorbed by the re-agents employed, the process becomes exceedingly simple; for if the residuum is under a hundred part of the measure, it may be transferred completely into the graduated tube, and its quantity at once ascertained.

The

The stopper S would have injected the fluid with greater velocity had it been straight; but it would not then have been so convenient in the analysis of compound gases, where both mercury and hot solutions are occasionally employed, as the mercury would have so compressed the fluid in the bottle, in introducing it under that metal, as to have thrown out a portion of its contents, and also have robbed the hot solutions of the temperature which was necessary for their perfect action.

As to the size of the measure M, I have generally preferred the cubic inch divided into hundred parts. This is easily effected by taking a stout glass tube about half an inch calibre, sealing one end, then weighing 3422 grains of mercury, equal to 252 grains of distilled water, at temperature 50° Fahrenheit. This is introduced into the tube; the extra length is cut off with a sharp-edged file, care being taken to leave a sufficient portion to grind the perforated stopper S into its mouth.

The divisions are obtained by a small measure, made from a glass tube sealed at the end, and cut off exactly to the hundred parts of a cubic inch, equal to 34·2 grains of mercury, which being ground flat, is stopped by a piece of plate glass, and the divisions marked by the diamond upon the introduction of each hundred part of mercury into the measure M.

The tube T is divided into tenths of the measure M, or thousand parts of a cubic inch. This is done by measuring one hundred part of a cubic inch into the tube, and dividing it into ten parts, marking the divisions with fluoric acid or black enamel.

To prove the accuracy of the instrument, I shall proceed to relate a few experiments made with it.

The elastic bottle being filled with the solution of sulphate of iron impregnated with nitrous gas, and the measure with atmospheric air, they were united, and by gentle injection $\frac{215}{1000}$ were absorbed.

If the experiment is made hastily, the impregnated solution loses a portion of its nitrous gas, which must be again absorbed by a solution of green sulphate of iron.

For

For ascertaining the purity of nitrous gas, the bottle may be charged with the solution of green sulphate or muriate of iron.

For carbonic acid gas, with lime or barytic water.

For oxygen gas, with the solution of green sulphate of iron impregnated with nitrous gas.

For sulphurated hydrogen gas, a solution of nitrate of silver was put in the elastic bottle, and sulphurated hydrogen gas † into the graduated measure. Upon the first injection, the solution took a black flocculent appearance, and a considerable portion of the gas was absorbed. After repeating the process as before mentioned, the residuum was $\frac{1}{1000}$.

The instrument may be likewise generally applied to the analysis of mixed gases.

I have been able completely to separate the carbonic acid gas from the sulphurated hydrogen by a solution of the nitrate of silver or of mercury, employed hot. The carbonic acid gas is expanded in this process, but on standing over mercury it returns to its original volume. The sulphurated hydrogen, in this instance, is taken up by the metallic nitrate. It should be here observed that the acetite of lead must not be used, as the carbonic acid gas, even at a high temperature, decomposes it, forming carbonate of lead.

The propriety of using the solutions hot, will be seen, when we recollect that the carbonic acid gas is soluble in the water of solution at the common temperature of all these compounds.

Nitrous gas and carbonic acid gas may be separated by means of the hot solution of the green sulphate of iron. To effect this, heat a solution on a glass capsule, over a spirit lamp, until ebullition. Having filled the measure with the compound gas, charge the elastic bottle with the hot solution, and unite them. The nitrous gas, in two or three injections, will be absorbed, changing the colour of the solu-

* Obtained from oxymuriate of potash by heat.

† Obtained from sulphuret of potash by diluted muriatic acid, and collected and preserved with the greatest care.

tion,

tion, while the carbonic acid gas will be a little rarefied, but no absorption of it will take place.

Previous to these experiments on the compound gases, I had tried several on the carbonic acid, sulphurated hydrogen, and nitrous gases in their unmixed states. 100 parts of pure alcohol at the common temperature will absorb 70 parts in volume of carbonic acid, and the same quantity of sulphurated hydrogen. Alcohol impregnated with the latter, precipitates the solutions of the nitrates of lead, silver, and mercury, of a dark brown colour. Nitric acid of the specific gravity 1·4, and also of 1·25, absorbs carbonic acid gas, without any apparent change in the nitric acid. Sulphurated hydrogen gas is also absorbed by nitric acid, which occasions a slight milky cloud or precipitate therein.

The solutions of nitrates of barytes, strontian, and lime, absorb carbonic acid gas equal to half their volume, without any apparent alteration.

Solutions of nitrates of barytes, strontian, and lime, also absorb sulphurated hydrogen gas, equal to six-tenths of their volume, with a slight change of colour; the solutions thus impregnated precipitate solutions of nitrates of mercury and of silver, and acetite of lead of a dark brown colour, and would be useful as chemical re-agents.

Carbonic acid gas, as I have before stated, decomposes solutions of the acetite of lead, hot or cold, forming a precipitate of carbonate of lead.

Carbonic acid gas is absorbed by the solution of the green sulphate of iron under the temperature of 100° Fahrenheit; but this is only the action of the water of solution. If the temperature be near boiling, or above 180° Fahrenheit, the solution increases the volume of the gas without the slightest absorption; after carbonic acid gas has in this way been treated with the hot solutions, it is still soluble in water at the common temperature, or in aqueous solutions of lime or alkali.

Nitrous gas is absorbed by solution of sulphuret of potash, with a separation or formation of sulphur. Upon injecting the solution the sides of the measure take a milky appearance,

appearance, which on the second injection is washed down insoluble in the liquor. About 80 parts from 100 of gas are absorbed.

Nitrous gas is also absorbed by nitrate of copper in solution, without any peculiar alteration.

In these experiments great care must be taken not to increase the temperature of the gas by the hand. To prevent this, I use a pair of small circular-mouthed forceps, lined with cloth, which firmly grasp the measure, fig. 5; and if the experiments should in any way be delayed, a corresponding manometer will always be sufficient to correct the error occasioned by change of atmospheric temperature and pressure.

To ascertain the quantity of carbonic acid gas contained in oxygen gas (of a known purity) after combustion or decomposition of carbonaceous substances, lime water will be found sufficient.

If it is required to know the purity of the oxygen gas after the carbonic acid gas has been absorbed, the best method and the least liable to error, is to withdraw the residual oxygen gas by means of the small graduated tube before described.

To do this, remove the measure into the small cistern of mercury; press the quicksilver out of the small bottle by the fingers and thumb, and let the tube rise a sufficient height within the measure, that the bottle, extending itself, shall withdraw the whole of the gas from the measure, taking care that the cock be stopped as soon as it has completed it, and also to prevent the solution from entering the tube.

If the opening of the tube is small, it may then be drawn down into the mercury, without the possibility of any portion of the gas escaping, while the measure is dried or cleaned, or a fresh one filled with mercury supplied to receive it.

This way of transferring will be found very advantageous, particularly in the separation of gases, liable to be absorbed under certain temperatures, and also where a new series of re-agents

re-agents are to be employed, as from the depositions of former solutions on the glass measure a source of considerable error would arise.

The residual oxygen gas being thus transferred into a clean dry measure, the processes before described for examining oxygen gas may be then used; or the quantity of carbonic acid gas (for examination) being found by lime water, another measure of the gas may be tried, first with the green sulphate of iron impregnated with nitrous gas, and then with the green sulphate in solution only: these will take up both the carbonic acid gas and the oxygen gas, leaving only such residual gas as the oxygen might have originally contained.

Transferring is not here necessary, as the two solutions may be used one after the other, taking care to use the solution of green sulphate last.

Where it is not requisite to transfer the gas into a dried or clean measure previous to the use of another solution, as in the instance I have just mentioned, a quantity of the first solution may be withdrawn, by simply filling the elastic bottle with mercury, then joining it to the measure, and by inclining the measure, the mercury by its gravity will displace the former solution.

If at any time the gas should get drawn into the elastic bottle, it may be very easily returned into the measure, by inclining sometimes the bottle, and sometimes the measure. The only error that could arise from this is, an increase of temperature in the gas, which may be rectified by plunging the whole apparatus into mercury or water of the standard temperature.

The advantages of this construction of the eudiometer will be readily perceived by all those who are in the habit of making chemical experiments. The portion of gas to be examined is completely under command; it may be agitated without the least fear of the intrusion of any atmospheric air, and the process thereby very materially shortened. The gum-elastic is a substance so little acted upon by chemical agents, that a great variety may be employed; and, above all, we can very conveniently use hot solutions, which will

be

be found an important auxiliary in the examination of some compound gases.

Simple as this instrument may appear, it is calculated to extend our knowledge of the different kinds of air, by the precision and accuracy which it enables us to obtain, and which solely constitutes the value of every experiment. A degree of confidence is inspired from knowing that we can depend upon our results; and hence much valuable time, which would have been wasted in uncertain, if not useless, investigations, may be directly applied to the advancement of science.

XXI. *On Public Libraries.*

To Mr. Tilloch.

SIR,

As you have, in some former Magazines, paid an attention to the establishment of public subscription libraries; that is, such libraries as are supported by the subscription of its members, the property whereof remains with them, in contradistinction to the common circulating libraries, I beg leave to forward you a small communication on that subject. I shall give you a plain relation of facts, which took place about four years ago, at North Shields, in the county of Northumberland, by which the laudable object in view was completely attained. And I shall subjoin a plan pursued by the members of the same library, by which they have now built a very excellent house, and are not only rent free, with most comfortable accommodations, but I believe their receipts, in part, pay also their worthy librarian. About the time mentioned above, three or four gentlemen living in North Shields, and who subscribed to an extensive library of that kind about seven miles off them, met, and were conversing about the expense of threepence per volume to them for carriage in addition to their annual subscription of 21 s. One of the gentlemen proposed to print off as many hand-bills as would circulate very freely through the town, recommending to the inhabitants the establishment of a public library, and at the same time proposing a meeting of

the friends to such an institution, on the morning of a certain day, at a very respectable inn, there to consult on the practicability of such a scheme. In a few minutes after the time appointed for the meeting, the number became so great that they were obliged to adjourn to a larger room in another house. A library was carried unanimously, and a subscription from each member of a guinea per year was determined on. About forty or fifty gentlemen immediately subscribed their guineas in advance; a room was obtained; and "The North Shields Subscription Library" established at once on a permanent and respectable basis.

The second part of the object I have in view in this communication is, to show how to accomplish such purposes at the cheapest rate, and at the same time to obtain pleasant and convenient accommodations: and this I shall do from the same respectable and active association.

About twelve months ago they received notice to quit the rooms they occupied: upon this, the plan of a library being endeared to them, as they advanced in the experience of its benefits, the committee proposed to purchase a piece of ground in a very advantageous situation in the high part of North Shields, and to build a house for their accommodation; and that a subscription paper should be laid upon the table. The sum for the purchase and building was estimated at 800*l.*, and the members at that period amounted to about 250; and the shares were not to be less than 5*l.* No member could take more than one for the first four weeks; after that, if the list was not filled, as many might be taken as the case allowed. Within six weeks 1200*l.*, or near that sum, was subscribed! The ground was purchased. The house is now finished, consisting of three stories: the ground floor contains two spacious and elegant counting-houses, which are let for 40*l.* or 50*l.* each, thus doing much more than paying the interest of the money; the second story contains the library room (which would hold with ease 7000 or 8000 volumes) and a room for the committee: above those is the attic story, which they mean to turn into an observatory: the purchasing of a telescope, and other astronomical instruments, is already in contemplation: the whole

whole is to be finished by an elegant town clock, by which means this liberal institution will be in some degree assimilated to the immediate convenience of North Shields. To obtain this, the committee divided themselves into parties of two or three, and went round the town soliciting subscriptions from the inhabitants, whether members of that association or not.

I had forgot, in its proper place, to observe, that the four gentlemen who first began this institution agreed, that if the distribution of the hand-bills had no permanent effect, the expense was to be divided amongst them, which they calculated at two or three shillings a-piece, or, in their words, "about the expense of half a bottle of wine:"—and what was that sacrifice for the probability of so respectable an advantage? If it did succeed, the expense was to be charged to the general funds. Thus, from the efforts of four gentlemen, at a very distant probability of the risk of two, three, or even four shillings each, has an establishment been formed, which is an ornament to the town of Shields: a lasting monument of the activity of these four friends of science: an institution from which peculiar benefits are already obtained by that town: a perpetual memorial of their alacrity in the cause of literature, and whose advantages must extend to generations yet unborn. The advantages obtained by the present inhabitants must be more rapidly enjoyed than in almost any other literary association; for, to their lasting honour, it must be observed, that from the beginning, ladies were admitted on equal terms, and with equal advantages as gentlemen; and I believe, were the subscription list for the new building examined, it would be found that nearly half of the sum had been subscribed by the first. To crown the climax of advantages, the rents of the offices on the ground-floor, as I before observed, do much more than pay the interest of the money advanced, and thus the library-room, &c. is rent free. Would not this consideration alone induce even the selfish man and the miser to countenance such plans of immediate advantage?

Dear sir, yours ever,

JOHN CLENNELL.

Newcastle upon Tyne.

P. S.

P. S. Should you think this worthy of insertion in your excellent miscellany, and the subject require further discussion, I shall be glad to meet the opinions of your correspondents. From the collision of sentiments it may happen that ideas may be suggested, by which the smallest general subscription library may become interesting even to a subscriber to the largest.

XXII. *Memoirs of the late* Erasmus Darwin, *M. D.*

[Continued from p. 48.]

We have to behold Dr. Darwin, for the sake of domestic happiness, quitting his old established connections, and a circle of the most sincere and attached friends, to settle at Derby, where he could be only known by reputation. A mind less elevated than his might have trembled at such a change, unless he had aspired to place his residence in London, where he was invited by several noble families, and which would have been a fit sphere for such extraordinary mental endowments. Confidence soon followed him at Derby; and it is certain, wherever he had chosen to settle himself, there any opposition would have been vain, and his establishment certain. His bride had a good jointure of her own; and added to Dr. Darwin's acquisitions in the practice of physic, his fortune was princely, and men of the first talents were ever at his table: yet he never relaxed the least in his medical exertions, and a letter was whimsically once addressed "To Doctor Darwin, on the road." He had such powers of mind, that the carriage became his study, and his travelling companions were books for study; he also contrived a writing-desk in his chaise; and it is said that most part of his performances were composed when travelling. His medical work, which occupied his chief attention, and which he calls *Zoonomia*, or The Laws of Organic Life, he laboured incessantly at for twenty years, and then, not as the poet recommends,

. . . . . nonum prematur in annum—

Hor.

but this work was, after its full completion, kept by the author another twenty long years, "that," as the Doctor expresses himself in the preface, "by frequent revision, it might be made more worthy the acceptance of the public." Every year keeping on amending and altering something, he was at last persuaded by his friends, and the alluring offer of a thousand pounds from Johnson the bookseller, to present it in the year 1794 to the world. "If," says the learned and ingenious author, "I could expend another forty years in the practice of medicine, I make no doubt I could bring this work nearer perfection, and render it more worthy the attention of *philosophers*."—Preface to volume ii.

It will be found by attention to the subject, that medicine, as a science, is chiefly indebted to *botanical* physicians. Only peruse the labours prior to the exertions of *botanical* physicians, and the whole is a chaos; and to such the world owes that clearness, order, and precision, which appear in many medical writings of the present day.

"The purport of the following pages," says Dr. Darwin in his preface, "is an endeavour to reduce the facts belonging to ANIMAL LIFE into *classes*, *orders*, *genera*, and *species*; and, by comparing them with each other, to unravel the theory of diseases. It happened, perhaps unfortunately for the inquirers into the knowledge of diseases, that other sciences had received improvement previous to their own; whence, instead of comparing the properties belonging to animated nature with each other, they, idly ingenious, busied themselves in attempting to explain the laws of life by those of mechanism and chemistry; they considered the body as an hydraulic machine, and the fluids as passing through a series of chemical changes, forgetting that *animation* was its essential characteristic.

"The great CREATOR of all things has infinitely diversified the works of his hands, but has at the same time stamped a certain similitude on the features of nature, that demonstrates to us, that *the whole is one family of one Parent*. On this similitude is founded all rational analogy; which, so long as it is concerned in comparing the essential properties of bodies, leads us to many and important discoveries; but when

when with licentious activity it links together objects, otherwise discordant, by some fanciful similitude, it may indeed collect ornaments for wit and poetry, but philosophy and truth recoil from its combinations.

"The want of a theory, deduced from such strict analogy, to conduct the practice of medicine, is lamented by its professors; for, as a great number of unconnected facts are difficult to be acquired, and to be reasoned from, the art of medicine is in many instances less efficacious under the direction of its wisest practitioners; and by that busy crowd, who either boldly wade in darkness, or are led into endless error by the glare of false theory, it is daily practised to the destruction of thousands: add to this the unceasing injury which accrues to the public by the perpetual advertisements of pretended nostrums: the minds of the indolent become superstitiously fearful of diseases which they do not labour under, and thus become the daily prey of some crafty empiric.

"A theory founded upon nature, that should bind together the scattered facts of medical knowledge, and converge into one point of view the laws of organic life, would thus on many accounts contribute to the interest of society. It would capacitate men of moderate abilities to practise the art of healing with real advantage to the public; it would enable every one of literary acquirements to distinguish the genuine disciples of medicine from those of boastful effrontery, or of wily address; and would teach mankind in some important situations the *knowledge of themselves.*"

To estimate truly the great superiority of this work, it may be necessary to say something of the several medical Nosologies that have been published. Linnæus, who had established order in the three kingdoms of nature, attempted a Nosology, or distinction of diseases into classes, orders, genera, and species. His plan is founded upon the same principles introduced into botany, and his arrangement is founded upon artificial distinctions. As no natural orders will, like Ariadne's clue, lead the naturalist through the labyrinth of nature, so diseases were by him classed according to symptoms, not the frequently obscure causes of them.

The illustrious Sauvage, the contemporary of Linnæus, both inventors of new systems* of botanical arrangement, carried the ideas of Linnæus to a still higher degree of perfection, and published in 1762 a very learned Nosology, where not only diseases are arranged into their respective classes, orders, genera, and species, and accurately defined, but also the causes of each disease is attempted to be pointed out, with the method of cure.

Various attempts were after that made to improve this important part of medical knowledge, and hence we possess the systems of Vogel, Sagar, Macbride, &c. and lastly the more finished labours of the celebrated Dr. Cullen, who for a great number of years, with great honour to himself, held the academic chair in the university of Edinburgh. In his "Synopsis Nosologiae Methodicae," the learned professor has added to his work the republication of the systems preceding, of which he speaks rather in too contemptuous terms: "Auctores hi aliquid laudis sine dubio merentur; quanquam enim eorum opera, rem ex toto confecisse minime videantur, nec multum utilitatis tyronibus inexpertis afferre queant; in arte tamen versatis, et in dignoscendis morbis aliquatenus exercitatis, nonnihil commodi exinde oriri possit."

He goes on to say, greatly complimenting LINNÆUS, "Norunt eruditi, III. LINNÆUM methodum plantarum perfectiorem reddidisse, eo, quod botanices linguam, usurpatis ubique vocibus maxime idoneis et definitis, magis accuratam effecit; nec quidem dubito quin delineatio morbi, ad instar delineationis plantae, a LINNÆO exhibitae, in Nosologia multum profutura sit. In Nosologia autem, ac in botanice, non aeque necessarium esse videtur; tum quod tam multae rerum circumstantiae, in Nosologia, ac in Botanice, notandae non veniunt; tum quod symptomatologia, in quibuscunque fere Pathologiae generalis systematibus exhibita, plurimum in hac re jam praestitit. Fatendum quidem, symptomatologias vulgo prolatas, nec adeo plenas esse, nec adeo ex-

* Linnæus is the author of a System founded on the Sexes of Plants, and Sauvage contrived a Method of finding out Plants by their Leaves.

actas, ac optandum esset; et, si pleniores fierent, atque ubique voces magis ideneae et accurate definitae usurpatae essent, ad Nosologiam perficiendam certe plurimum conferre posset. In hujusmodi vero tentamine cavendum est, ne distinctiones nimium subtiles et dubiae adhibeantur, uti ab auctore *Observationum Clinicarum*, quae Warsaviae annis 1767 et 1768 prodierant, factum fuisse opinor. Ipse quidem hujusmodi nihil tentavi, tum quod plus exegisset, quam per longum tempus mihi suppetivit otii, tum quod mihi minus necessarium videtur, qui voces apud medicos usitatissimas, et in sensu vulgo recepto ubique fere usurpandas curaverim.

" Quod ad denominationem morborum attinet, in Classium, Ordinum, et Generum nominatione, eas, quantum potui, regulas observavi, quae in LINNÆI *Criticis Botanicis*, et in ejusdem *Philosophia Botanica*, ab illo auctore traduntur.

" Quando notiones novae sunt proferendae, etiam nova nomina imponenda sunt, et ejusmodi aliquando, parcius licet, adhibuimus. Cum vero nomenclaturam medicam, diuturno usu confirmatam, sine gravi causa mutare non liceat; ne factum esset ubique curavimus; quod tamen Ill. LINNÆUM saepe, nulla urgente necessitate, fecisse, et VOGELIUM appellationibus novis, frivolis, ineptisque, Nosologiam deturpasse, observavimus."

Unfortunately for the perfectioning of this branch of science, Cullen *was no botanist*, and hence his definitions will not stand the test of careful examination.

Not to take up too much of the valuable time of the philosophic reader, we shall only point out a few instances of such deficiency. Cullen defines ENTERITIS (*Inflammation of the bowels*):

" Pyrexia typhodes; dolor abdominis pungens, tendens, circa umbilicum torquens; vomitus; *alvus pertinaciter adstricta:*" of which he makes two species.

" Species sunt,

" 1. ENTERITIS (*phlegmonodaea*) dolore acuto, pyrexia vehementi, *vomitu* et alvo *astricta*.

" 2. ENTERITIS (*erythematica*) dolore et pyrexia leniori-bus, *sine vomitu*, et *cum diarrhoea*."

Now the generic character should certainly run through all the species, and what should be the discriminating character is, by Cullen, here brought into the generic character.

After this specimen, and never corrected, though his Nosology went through five editions, the philosophic world may form a tolerable opinion of Dr. Cullen's want of judgement, or rather knowledge, in this department of science.

In his definition of NEPHRITIS, he introduces "testiculi ejusdem lateris retractio aut dolor;" which symptom, as only applicable to one sex, should not have come into the generic character, but only been made as a remark.

In the class of fevers comes ODONTALGIA, (the tooth-ache,) defined as arising from a caries in the tooth, though he finishes his work by genus "CLI. CARIES, ossis exulceratio."

In his class EXANTHEMATA, he thus badly defines VARIOLA (small-pox):

"Synocha contagiosa *cum vomitu*, et ex *epigastrio presso*, dolore,

"*Tertio die* incipit, et *quinto* finitur eruptio papularum phlegmonodearum, quae, spatio *octo dierum*, in suppurationem, et in crustas demum abeunt, saepe cicatrices depressas, sive foveolas in cute, relinquentes.

"Species sunt,

"I. VARIOLA (*discreta*) pustulis paucis, discretis, circumscriptione circularibus, turgidis; febre, eruptione facta, protinus cessante.

"II. VARIOLA (*confluens*) pustulis numerosis, confluentibus, circumscriptione irregularibus, flaccidis, parum elevatis; febre post eruptionem perstante."

"Surely, as the infection," to use the language of Dr. Darwin, "from the *distinct* small-pox, produces also the *confluent* kind, and *vice versâ*, it would seem more analogous to *botanical* arrangement, which Nosologists *profess* to imitate, to call the *distinct* and *confluent* small-pox, rather *varieties* than species."

He is still more defective in his definition of VARICELLA (chicken-pox):

"Synocha,

"Synocha. Papulae post brevem febriculam erumpentes, in pustulas *variolae similes*, sed *vix* in suppurationem euntes; post *paucos dies* in squamulas, *nulla cicatrice relicta*, desinentes."

As his definition of the small-pox is too precise*, so that of the chicken-pox is too vague; and that the last never leaves an *escar* behind, is contradicted by daily experience.

Amongst the order EXANTHEMATA, which is thus defined,

"Morbi contagiosi, semel tantum in decursu vitae aliquem afficientes; cum febre incipientes; definito tempore apparent phlogoses, saepe plures, exiguae per cutem sparsae," appear ERYSIPELAS and URTICARIA.

That these are not contagious is known to all; and to confirm it, Dr. Thornton suffered himself to be inoculated by Dr. Willan, from a subject who had the *Erysipelas* in the highest degree, without any effect.

Rather with more propriety, PESTIS (the Plague) is arranged under this order, disjointed from TYPHUS GRAVIOR, although it is supposed that persons are liable to the attack more than once in their life.

Speaking of APHTHA (the thrush), Cullen, in a note, very properly says, "An aphtha inter exanthemata recensenda sit, dubito."

In the class NEUROSES, which is thus defined,

"*Sensus* et *motus* laesi, *sine pyrexia idiopathica*, et *sine morbo locali*,"

Is the order ADYNAMIAE,

"*Motus* involuntarii, sive vitales sive naturales, imminuti," under which is classed Gen. XLV. DYSPEPSIA.

And in the order of SPASMI (spasms), in the above class, appears PERTUSSIS (the hooping-cough), disjointed from those other contagious disorders which only appear once in the course of life.

DIARRHOEA (a looseness) is made to figure also among the spasms.

PSORA (the itch), and FRACTURA (a fracture of a bone), follow each other under the same class and order.

Dr. Darwin very justly complains "that Nosologists are

* The seven, nine, and eleven *day* pock is in the mouth of every old woman.

not only defective in the distribution of their genera, but that in many genera the *species* have also no analogy to each other, either in respect to their proximate cause, or to their proximate effect, though they may be somewhat similar in less essential properties: thus the *thin* and saline discharge from the nostrils on going into the cold air of a frosty morning, which is owing to the *deficient action* of the absorbent vessels in the nostrils, is *one* species; whereas the *viscid* mucus discharged from the secerning vessels of the same membrane, when *inflamed*, is another species of the same genus, viz. catarrhus, which bears no analogy in respect to the cause, or the mode of treatment."

Dr. Darwin wished his Nosology to point out at the same time the mode of treatment, a plan *first* happily suggested by the *unfortunate* Dr. Brown, which reflects on that illustrious genius the highest and eternal honour:—*Unfortunate*, have I said? Yes:—because his merits did not lead to respect and honour, but persecution: and his wife is now lodged in London, in a lane, in great distress:—and Dr. Darwin, aware of this coincidence, Dr. Brown having *first* published*, was obliged to appeal to his friends, "who," he declares, "saw his Zoonomia twenty years before it appeared in the world."

"The uses of the method here offered," says Dr. Darwin, "to the public, of classing diseases according to their proximate causes, are, first, more distinctly to understand their nature by comparing their essential properties. Secondly, to facilitate the knowledge of the methods of cure; since, in natural classification of diseases, the species of each genus, and indeed the genera of each order, a few perhaps excepted, require the same general medical treatment. And lastly, to discover the nature and the name of any disease previously unknown to the physician; which I am persuaded will be more readily and more certainly done by this natural system, than by the artificial classifications already published.

* Dr. Darwin, speaking of Dr. Brown's Elements of Physic, says "that it is, with a *few* exceptions, a work of *great genius*." The wife and sons of Dr. Brown have met with a liberal benefactor in Dr. Thornton.

"The

"The common names of diseases are not well adapted to any kind of classification, and least of all to this from their proximate causes. Some of their names in common language are taken from the remote cause, as worms, stone of the bladder; others from the remote effect, as diarrhœa, salivation, hydrocephalus; others from some accidental symptom of the disease, as tooth-ache, head-ache, heart-burn; in which the pain is only a concomitant circumstance of the excess or deficiency of fibrous actions, and not the cause of them. Others again are taken from the deformity occasioned in consequence of the unnatural fibrous motions, which constitute diseases, as tumours, eruptions, extenuations: all these therefore improperly give names to diseases; and some difficulty is thus occasioned to the reader in endeavouring to discover to what class such disorders belong.

"Another difficulty attending the names of diseases is, that one name frequently includes more than one disease, either existing at the same time or in succession. Thus the pain of the bowels from worms is caused by the increased action of the membrane from the stimulus of those animals: but the convulsions which sometimes succeed these pains in children, are caused by the consequent volition, and belong to another class.

"To discover under what class any disease should be arranged, we must first investigate the proximate cause: thus the pain of the tooth-ache is not the cause of any diseased motions, but the effect; the tooth-ache therefore does not belong to the class of Sensation. As the pain is caused by increased or decreased action of the membranes of the tooth, and these actions are owing to the increase or decrease of irritation, the disease is to be placed in the class of Irritation.

"To discover the order, it must be inquired, whether the pain be owing to increased or defective motion of the pained membrane; which is known by the concomitant heat or coldness of the part. In tooth-ache without inflammation there is generally a coldness attends the cheek in its vicinity; as may be perceived by the hand of the patient himself,

himself, compared with the opposite cheek. Hence odontalgia is found to belong to the order of Decreased Irritation. The genus and species must be found by inspecting the synopsis of the second order of the class of Irritation. See Class I. 2. 4. 12.

"This may be further elucidated by considering the natural operation of parturition; the pain is occasioned by the increased action or distention of the vessels of the uterus, in consequence of the stimulus of the fœtus; and is therefore caused by increased irritation; but the actions of the abdominal muscles in its exclusion are caused by the pain, and belong to the class of Increased Sensation. See Class II. 1. 1. 12. Hence the difficulty of determining, under what class of diseases parturition should be arranged, consists in there being two kinds of diseased actions comprehended under one word; which have each their different proximate cause.

"In Sect. XXXIX. 8. 4., and in Class II. 1. 1. 1., we have endeavoured to give names to four links of animal causation, which conveniently apply to the classification of diseases: thus in common nictitation, or winking with the eyes without our attention to it, the increased irritation is the proximate cause; the stimulus of the air on the dry cornea is the remote cause; the closing of the eyelid is the proximate effect; and the diffusion of tears over the eyeball is the remote effect. In some cases two more links of causation may be introduced; one of them may be termed the pre-remote cause; as the warmth or motion of the atmosphere, which causes greater exhalation from the cornea. And the other the post-remote effect; as the renewed pellucidity of the cornea; and thus six links of causation may be expressed in words.

"But if amid these remote links of animal causation any of the four powers or faculties of the sensorium be introduced, the reasoning is not just according to the method here proposed; for these powers of the sensorium are always the proximate causes of the contractions of animal fibres; and therefore in true language cannot be termed their remote causes. From this criterion it may always be determined, whether

whether more diseases than one are comprehended under one name; a circumstance which has much impeded the investigation of the causes and cures of diseases.

"Thus the term fever is generally given to a collection of morbid symptoms; which are indeed so many distinct diseases, that sometimes appear together, and sometimes separately: hence it has no determinate meaning, except it signifies simply a quick pulse, which continues for some hours; in which sense it is here used."

Let us now criticise this new plan of arrangement. The first volume, I speak now of the quarto edition, (575 pages) is taken up in clearing the way for a perfect understanding of the second. It consists of forty sections: "Section I. Of motion. II. Explanations and definitions. III. The motions of the retina demonstrated by experiments. IV. Laws of animal causation. V. Of the four faculties or motions of the sensorium. VI. Of the four classes of fibrous motions. VII. Of irritative motions. VIII. Of sensitive motions. IX. Of voluntary motions. X. Of associate motions. XI. Additional observations on the sensorial powers. XII. Of stimulus, sensorial exertion, and fibrous contraction. XIII. Of vegetable animation. XIV. Of the production of ideas. XV. Of the classes of ideas. XVI. Of instinct. XVII. The catenation of animal motions. XVIII. Of sleep. XIX. Of reverie. XX. Of vertigo. XXI. Of drunkenness. XXII. Of propensity to motion. Repetition. Imitation. XXIII. Of the circulatory system. XXIV. Of the secretion of saliva, and of tears, and of the lacrymal sac. XXV. Of the stomach and intestines. XXVI. Of the capillary glands, and of the membranes. XXVII. Of hæmorrhages. XXVIII. The paralysis of the lacteals. XXIX. The retrograde motions of the absorbent vessels. XXX. The paralysis of the liver. XXXI. Of temperaments. XXXII. Diseases of irritation. XXXIII. Diseases of sensation. XXXIV. Diseases of volition. XXXV. Diseases of association. XXXVI. The periods of diseases. XXXVII. Of digestion, secretion, nutrition. XXXVIII. Of the oxygenation of the blood in the lungs

lungs and placenta. XXXIX. Of generation. XL. Of ocular spectra."

The second is called Part II., "containing a Catalogue of Diseases distributed into natural classes, according to their proximate causes, with their subsequent orders, genera, and species, and with their methods of cure."

His motto is extremely *modest*:

"Hæc, ut potero, explicabo; nec tamen, quasi Pythius Apollo, certa ut sint et fixa, quæ dixero; sed ut Homunculus unus e multis probabiliora conjecturâ sequens Cic. Tusc. Disp. I. 1. 9."

But having finished his work, he devotes an entire page to *exultation*, which he makes thus:

"*Lines, to be placed at the end of Zoonomia. By a Friend.*

"JAMQUE OPUS EXEGI. *Hor.*

"The work is done!—Nor Folly's active rage,
Nor Envy's self, shall blot the golden page;
Time shall admire, his mellowing touch employ,
And mend the *immortal* tablet, not destroy."

Taking the word *Disease* in the usual acceptation of the word, nothing can astonish so much as our finding among the catalogue of *Diseases*, "Class I. Genus 3, Species 13, CICATRIX VULNERUM,—Healing of wounds. Class I. Order 3, Genus 1, Species 1, RUMINATIO,—Chewing the chud. Class II. Genus 7, Species 7, RUBOR A CALORE,—Blush from heat. Same class, order, and genus, species 10, DISTENTIO MAMULARUM,—Distention of the nipples. Class III. Genus 2, Species 7, IRA,—Anger. Species 24, SYMPATHIA,—Pity. Class III. Order 2, Genus 1, Species 12, SOMNUS,—Sleep. Class IV. Genus 4, VITA OVI,—Life of an egg."

However these may excite a smile, this is more owing to deficiency of language, and a want of acquaintance with the sublime notions of the author, than arising from the things themselves: for the ingenious fabricator of this new system of Nosology has before acquainted the reader that his work treats of "*motion*; for that the whole of nature is composed of two parts, one of which might be termed *spirit*, and the other *matter*. These *motions* have formed the objects of natural philosophy and chemistry; and the *motions* dependent upon life, medicine."

Had

Had Dr. Darwin used the word *action* instead of *diseases*, he would not have so greatly surprised the world by his wonderful catalogue, as he terms his *diseases*; nor would the splitting all the *symptoms*, and constituting out of these so many diseases, now appearing all novelties, have so greatly offended at the onset, the medical reader brought up in the old school. Brown, Darwin, and Thornton, have each formed a *new* system of nosology. Upon the whole, we cannot approve of the *old plan* of *artificial* arrangement, not quite that invented by Linnæus, Vogel, Sauvage, Cullen, &c., nor even that of Dr. Brown, who divides his diseases into Sthenic and Asthenic, for the facility of comprehension and cure, nor even that of Dr. Darwin, but that invented by Dr. Thornton*, who begins with diseases of the head, and so descends to other parts, dividing these into sthenic and asthenic, and reserving a separate class for contagious diseases, and fevers, or general affections.

[To be continued.]

XXIII. *Some Account of a Journey to the Frozen Sea, and of the Discovery of the Remains of a Mammoth. By M.* Michael Adams, *of St. Petersburgh. Translated from the French* †.

I should have reason to reproach myself were I to delay any longer the publication of a discovery in Zoology, which is so much the more interesting to be detailed, as it once more presents to our view a species of animal, the existence of which has been a subject of dispute among the most celebrated naturalists.

I was informed at Jakoutsk by M. Popoff, who is at the head of the company of merchants of that town, that they had discovered upon the shores of the Frozen Sea, near the mouth of the river Lena, an animal of an extraordinary size: the flesh, skin and hair were in good preservation, and it was

* This *System* may be seen in his "Philosophy of Medicine," fourth edition, five volumes, a work which deserves a place in every library.

† For this communication we are indebted to the Right Hon. Sir Joseph Banks, Bart. P. R. S. &c. &c.

supposed

supposed that the fossile production, known by the name of mammoth horns, must have belonged to some animal of this kind.

Mr. Popoff had, at the same time, the goodness to communicate the drawing and description of this animal; I thought proper to send both to the President of the Petersburgh Academy. The intelligence of this interesting discovery determined me to hasten my intended journey to the banks of the Lena as far as the Frozen Sea, and I was anxious to save these precious remains, which might perhaps otherwise be lost. My stay at Jakoutsk, therefore, only lasted a few days. I set out on the 7th of June 1806, provided with some indispensable letters of recommendation, some of which were addressed to the servants of the government, and others to merchants, from whom I hoped to derive some advantages. On the 16th of June I arrived in the small town of Schigarsk, and towards the end of the same month I reached Kumak-Surka: from this place I made an excursion, the express object of which was to discover the mammoth. And I shall now give a sketch of my journey.

The contrary winds, which lasted during the whole summer, retarded my departure from Kumak-Surka; this place was then inhabited by 40 or 50 Toungouse families of the Batouline race. Fishing was their ordinary occupation, and the extreme activity of these people filled me with admiration: the women, old men, and even children, laboured with indefatigable assiduity in laying up provisions for winter. The strongest went a-fishing, the less robust were occupied in cleaning and drying the fish. The whole shores were covered with scaffolding, and the cabins so filled with fish that we could scarcely enter them. An innocent gaiety reigned in every countenance, and all exhibited the utmost activity. The fishermen sang while casting their nets, and others were dancing the Charya, which is a dance peculiar to the country. I cannot sufficiently express the emotions of joy which I felt at the sight of these pleasing scenes.

I was convinced, while upon the spot, that the inhabitants of the North enjoy happiness even in the midst of the frozen regions.

But

But what astonished me still more, was the picturesque view of the opposite side of the Lena. This river, which is one of the largest in Siberia, majestically rolls its waters through the mountainous chain of Verschéjansk: it is here, near its mouth, entirely devoid of islands, and much narrower, deeper and more rapid than in any place of its course. The mountains here appear in a great variety of forms; they are of a brilliant whiteness, and of a savage and horrid aspect; sometimes they represent immense columns which rise into the clouds, sometimes they resemble the ruins of antient forts, and as if they were parts detached from the mutilated remains of grotesque and gigantic figures.

Further off the horizon is terminated by a chain of high mountains, where eternal snow and ice dart back the rays of the sun.

These landscapes are of exquisite beauty; an expert draughtsman would look in vain for similar views in any other place of Siberia; and I am not astonished that the picturesque situation of Kumak-Surka should become the object of a national song, known solely on the shores of the Frozen Sea. I reserve the communication of this curious article until I publish the detailed account of my journey.

The course of the winds having at last changed, I thought of pursuing my route, and I had my rein-deer brought across the river. Next day at day-break, I set out accompanied by a Toungouse chief, Ossip Shoumachoff, and by Bellkoff, a merchant of Schigansk, and attended by my huntsman, three Cossacs, and ten Toungouses.

The Toungouse chief was the first person who discovered the mammoth, and he was proprietor of the territory through which our route lay. Bellkoff the merchant had spent nearly his whole life on the shores of the Frozen Sea. His zeal, and the details he procured me, have the strongest claims to my gratitude: I am even indebted to him for the preservation of my life at a moment of imminent danger.

At first I found great difficulty in sitting upon a rein-deer; for, the saddle being attached by a girth of leather only, it was very insecure, and often occasioned me very disagreeable falls. Besides, my position was very inconvenient for want

want of stirrups, which are never used among the Toungouses.

On our route we traversed high and rugged mountains, valleys which followed the course of small rivulets, and parched and savage plains, where not a shrub was to be seen. After two days travelling, we at last approached the shores of the Frozen Sea. This place is called by the Toungouses Angardam, or terra firma. In order to attain the mammoth, it was necessary to traverse another isthmus, called Bykoffskoy-Mys or Tumut. This isthmus, which projects into a spacious gulf, is to the right of the mouth of the Lena, and extends, as I was informed, from South-east to North-east for about 30 or 35 wersts*. Its name is probably derived from two points in the form of horns, which are at the North extremity of this promontory. The point upon the left hand, which the Russians call by way of eminence Bykoffskoy-Mys, on account of its greater extent, forms three vast gulfs, where we find some settlements of Jakouts: the opposite point, called Maustach on account of the great quantity of floating wood found upon its shores, is one half smaller; its shore is lower, and this district is completely inhabited. The distance from the one point to the other is estimated at four leagues and a half, or 45 wersts. Small hills form the higher part of the peninsula of Tumut; the remainder is occupied by lakes, and all the low grounds are marshy.

The principal lakes are: 1st, Chastirkoöl, which means the lake of geese; 2d, Kourilakoöl; 3d, Beulgeuniachtachkoöl, the lake of hillocks; 4th, Omoulachkoöl; 5th, Mougourdachkoöl, where a particular kind of salmon is found, called tchir; and 6th, Bachofkqöl. The lake No. 4 is the largest, and No. 5 is the deepest of all. The lake No. 6 derives its name from two famous adventurers, Bachoff and Schalauroun, who spent a whole winter on its banks. We still see the ruins of a cabin in which they resided. The history of their unfortunate end is told by M. Sauer in his Journal of Billings's expedition.

* 10 wersts are equal to 6 English geographical miles.

The

The isthmus we have mentioned is so narrow at some places that the sea may be seen on both sides. The rein-deer perform a periodical transmigration every year, during which they abandon these places, in order to proceed by the Frozen Sea towards Borschaya and Uitjansk, and for this purpose they collect in large troops about autumn. In order to hunt these animals with greater prospect of success, the Toungouses have divided the peninsula into cantons, separated by palings. They frighten the deer by loud cries, which they utter all at once, by letting dogs loose at them, and by fans which they attach to the palings, and which are agitated by the wind. The terrified rein-deer throw themselves into the water in order to reach some neighbouring island, where they are pursued and killed by the hunters.

On the third day of our journey we pitched our tents a few hundred paces from the mammoth, upon a hillock called Kembisagashaeta, which signifies the stone with the broad side.

Schoumachoff related to me the history of the discovery of the mammoth in nearly the following terms :—

" The Toungouses, who are a wandering people, seldom remain long in one place. Those who live in the forests often spend ten years and more in traversing the vast regions among the mountains : during this period they never visit their homes. Each family lives in an isolated state from the rest; the chief takes care of them, and knows no other society. If, after several years absence, two friends meet by chance, they then mutually communicate their adventures, the various success of their hunting, and the quantity of peltry they have acquired. After having spent some days together, and consumed the little provisions they have, they separate cheerfully, charge each other with compliments for their respective friends, and leave it to chance to bring them together again. Such is the way of life of these innocent children of Nature. The Toungouses who inhabit the coast differ from the rest, in having more regularly built houses, and in assembling at certain seasons for fishing and hunting. In winte they inhabit cabins, built close to each other, so as to from small villages.

"It is to one of these annual excursions of the Toungouses that we are indebted for the discovery of the mammoth. Towards the end of August, when the fishing in the Lena is over, Schoumachoff is in the habit of going along with his brothers to the peninsula of Tumut, where they employ themselves in hunting, and where the fresh fish of the sea furnish them with wholesome and agreeable nourishment.

"In 1799, he had caused to be built for his women, some cabins upon the shores of the lake Onroul; and he himself coasted along the sea shore for the purpose of searching for some mammoth horns. One day he perceived in the midst of a rock of ice an unformed block, which did not at all resemble the floating pieces of wood usually found there. In order to examine it more closely, he clambered up the rock and examined this new object all around; but he could not ascertain what it was. The year following he discovered in the same spot, the carcase of a sea-cow (*Trichecus Rosmarus*). He perceived at the same time that the mass he had formerly seen was freer from the ice, and by the side of it he remarked two similar pieces, which he afterwards found were the feet of the mammoth. About the close of the next summer, the entire flank of the animal and one of the tusks had distinctly come out from under the ice. Upon his return to the shores of the lake Onroul, he communicated this extraordinary discovery to his wife and some of his friends; but their manner of regarding the subject overwhelmed him with grief. The old men related on this occasion, that they had heard their forefathers say that a similar monster had formerly shown itself in the same peninsula, and that the whole family of the person who discovered it had become extinct in a very short time. The mammoth, in consequence of this, was unanimously regarded as auguring a future calamity, and the Toungouse chief felt so much inquietude from it, that he fell dangerouly ill; but becoming well again, his first ideas suggested to him the profit he might gain by selling the tusks of this animal, which were of an extraordinary size and beauty. He therefore gave orders to conceal carefully the place where the mammoth was, and to remove all strangers from it under various pretexts, charging at

at the same time some trusty dependents not to suffer any part of this treasure to be carried away.

"But the summer being colder and more windy than usual, kept the mammoth sunk in the ice, which scarcely melted at all that season. At last, about the end of the fifth year afterwards, the ardent desires of Schoumachoff were happily accomplished: the ice which inclosed the mammoth having partly melted, the level became sloped, and this enormous mass, pushed forward by its own weight, fell over upon its side on a sand-bank. Of this two Toungouses were witnesses who accompanied me in my journey. In the month of March 1804, Schoumachoff came to his mammoth, and having got his horns cut off, he changed them with Baltounoff the merchant for merchandise of the value of 50 roubles. On this occasion a drawing of the animal was made, but it was very incorrect; they described it with pointed ears, very small eyes, horses' hoofs, and a bristly mane along the whole of his back; so that the drawing represented something between a pig and an elephant."

Two years afterwards, being the seventh from the discovery of the mammoth, a fortunate circumstance occasioned my visit to these distant and desert regions, and I congratulate myself upon having it in my power to ascertain and verify a fact, which would otherwise be thought so improbable.

I found the mammoth still upon the same spot, but completely mutilated. The prejudices against it having been dissipated, because the Toungouse chief had recovered his health, the carcase of the mammoth might be approached without any obstacle: the proprietor was content with the profit he had already derived from it, and the Jakouts of the neighbourhood tore off the flesh, with which they fed their dogs. Ferocious animals—white bears of the north pole, gluttons, wolves, and foxes—preyed upon it also, and their burrows were seen in the neighbourhood. The skeleton, almost completely unfleshed, was entire, with the exception of one of the fore feet. The spondyle, from the head to the os coccygis, a shoulder-blade, the pelvis, and the remains of the three extremities, were still tightly attached by the

nerves of the joints, and by strips of skin on the exterior side of the carcase. The head was covered with a dry skin; one of the ears, well preserved, was furnished with a tuft of bristles. All these parts must necessarily have suffered by a carriage of 11,000 wersts. The eyes, however, are preserved, and we can still distinguish the ball of the left eye. The tip of the under lip has been eaten away, and the upper part, being destroyed, exhibited the teeth. The brain was still within the cranium, but it appeared dry.

The parts least damaged are a fore foot and a hind one; they are covered with skin, and have still the sole attached. According to the assertion of the Toungouse chief, the animal had been so large and well fed, that its belly hung down below the knee joints. This mammoth is a male, with a long mane at his neck, but it has no tail and no trunk. The skin, three-fourths of which are in my possession, is of a deep gray, and covered with a reddish hair and black bristles. The humidity of the soil where the animal has lain so long, has made the bristles lose some part of their elasticity. The entire carcase, the bones of which I collected upon the spot, is 4 archines and a half high by 7 long, from the tip of the nose to the coccyx*; without however comprehending the two horns, each of which is a toise and a half long, and both together weigh 10 pouds†. The head alone weighs eleven pouds and a half.

The principal object of my care was to separate the bones, to arrange them and place them in safety: this was done with the most scrupulous nicety, and I had the satisfaction of finding the other shoulder-blade, which lay in a hole. I afterwards caused the skin to be stripped from the side upon which the animal had lain; it was very well preserved. This skin was of such an extraordinary weight, that ten persons who were employed to carry it to the sea side, in order to stretch it on floating wood, moved it with great difficulty. After this operation I caused the ground to be dug in various places in order to see if there were any bones around, but

* An archine is a little more than two feet English measure.

† A poud is 40 pounds.

chiefly

chiefly for the purpose of collecting all the bristles which the white bears might have trodden into the wet ground on devouring the flesh. This operation was attended with difficulty, as we wanted the necessary instruments for digging the ground: I succeeded however in procuring in this manner more than one poud weight of bristles. In a few days our labour was ended, and I found myself in possession of a treasure, which amply recompensed me for the fatigues and dangers of the journey, and even for the expenses I had incurred.

The place where I found the mammoth is about 60 paces distant from the shore; and from the fracture of the ice from which it slid it is about 100 paces distant. This fracture occupies the middle precisely between the two points of the isthmus, and is three wersts long, and even in the place where the mammoth was, this rock has a perpendicular elevation of 30 or 40 toises. Its substance is a clear ice, but of a nauseous taste; it inclines towards the sea; its summit is covered with a bed of moss and friable earth half an archine in thickness. During the heat of the month of July a part of this crust melts, but the other remains frozen.

Curiosity prompted me to ascend two other hillocks equally distant from the sea; they were of the same composition, and also a little covered with moss. At intervals I saw pieces of wood of an enormous size, and of all the species produced in Siberia; and also mammoth horns in great quantities frozen between the fissures of the rocks. They appeared to be of an astonishing freshness.

It is as curious as it is difficult to explain how all these things are to be found collected here. The inhabitants of the coast call this kind of wood Adamsohina, and distinguish it from the floating wood, which descending the great rivers of Siberia falls into the ocean, and is afterwards heaped upon the shores of the Frozen Sea. This last kind they call Noahsohina. I have seen in great thaws, large pieces of earth detach themselves from the hillocks, mix with the water, and form thick and muddy torrents which roll slowly towards the sea. This earth forms in different places lumps, which sink in among the ice. The block of ice where the mam-

moth was found, was from 35 to 40 toises high; and, according to the account of the Toungouses, the animal when first discovered was seven toises from the surface of the ice.

The whole shore was as it were covered with the most variegated and beautiful plants produced on the shores of the Frozen Sea; but they were only two inches high. Around the carcase we saw a multitude of other plants, such as the *Cineraria aquatica* and some species of *Pedicularis*, not yet known in natural history.

While waiting for the boats from Terra Firma, for which I had sent some Cossacs, we exerted all our endeavours to erect a monument to perpetuate the memory of this discovery and of my visit. We raised, according to the custom of these countries, two crosses with analogous inscriptions. The one was upon the rock of ice, 40 paces from the shelf from which this mammoth had slid, and the other was upon the very spot where we found it. Each of these crosses is 6 French toises high, and constructed in a manner solid enough to brave the severity of many ages. The Toungouses have given to the one the name of the cross of the Ambassador, and to the other that of the cross of the Mammoth. The eminence itself received the name of Selichaëta or Mammoth mountain. This last will perhaps some day or other afford some traveller the means of calculating with sufficient precision how much the mountains of ice lose annually of their primitive height.

I made two additional excursions for the purpose of acquiring some more precise notions upon the nature of this peninsula, and my discoveries in zoology and botany perfectly answered my expectations. I found a great quantity of amber upon the shores; but in no piece whatever could I discover the least trace of any marine production. I should, perhaps, attribute this to the proximity of the river, and perhaps also to the depth of the sea, or abruptness of the shore. I had occasion to examine more closely the effects of the flux and reflux: this has escaped M. Sauer, who saw nothing of it at the mouth of the Colima.

Our Cossacs not having arrived in time with the boat, I

was

was obliged to return to the continent with my rein-deer, without waiting for them. The vessel, in the mean time, had cast anchor in the bay of Borchaya, three hundred wersts from the isthmus where I was. We arrived without any accident, after a journey of eight days. A week afterwards I had the satisfaction to see the mammoth arrive. Our first care was to separate, by boiling, the nerves and flesh from the bones; the skeleton was then packed, and placed at the bottom of the hold. When we arrived at Jakoutsk, I had the good fortune to purchase the tusks of the mammoth; and thence I dispatched the whole for St. Petersburgh.

A question of some magnitude remains to be resolved:— Are the mammoth and elephant animals of the same species, as asserted by Buffon, Pallas, Isbrand Ides, Gmelin, and, above all, Daubenton? or should we, in preference, rely upon the opinion of M. Cuvier, who asserts that the mammoth occupies the second place among the extinct species of animals? As I do not intend, in this place, to make an exact comparison of the skeletons of a mammoth and an elephant, I shall content myself with relating here some characteristic marks which distinguish the two species: I reserve for a particular memoir some more detailed observations upon this subject. I shall here recapitulate the motives which induced me to adopt the opinion of M. Cuvier.

1. If the writers whom I have mentioned have actually made, as I suppose, zootomical comparisons, they have been able to do so very incompletely, and upon detached pieces; for neither the head, nor the whole vertebræ, nor the feet of the mammoth covered with flesh and hair, and furnished with the sole, have ever yet been examined, when collected together, by any writer.

The presence of the coccyx, which finishes the vertebral column, convinces me that the animal has had a very short and thick tail, like its feet: besides, its being every where covered with bristles induces me to think that they cannot be those of an ordinary elephant.

2. The teeth of the mammoth are harder, heavier, and

more twisted in a different direction than the teeth of an elephant. Ivory-turners, who have wrought upon these two substances, say that the mammoth's horn, by its colour and inferior density, differs considerably from ivory. I have seen some of them which formed in their curvature three fourths of a circle; and at Jakoutsk, another of the length of two toises and a half, and which were an archine thick near the root, and weighed seven pouds. It is to be remarked, that the point of the tusks on the exterior side is always more or less worn down: this enables the inhabitants of the Frozen Sea to distinguish the right from the left tusk.

The mammoth is covered with a very thick hair through the whole body, and has a long mane upon its neck. Even admitting that I doubted the stories of my travelling companions, it is nevertheless evident that the bristles of the length of an archine, which were also found upon the head, the ears, and the neck of the animal, must necessarily have belonged either to the mane or to the tail. Schoumachoff maintains that he never saw any trunk belonging to the animal, but it is probable that it was carried off by wild beasts; for it would be inconceivable that the mammoth could eat with so small a snout, and with such enormous tusks, if we do not allow it to have had a trunk. The mammoth, according to these indications, would consequently belong to the elephant species, and M. Blumenbach, in his system, actually calls it *Elephas primœvus*.

To conclude:—The mammoth in my possession is quite different from that found near New York, which, from the description given in the Journal called the *Museum des Wundervollen*, had carnivorous teeth*. M. Cuvier has proved in a most satisfactory manner, that the mammoth is a particular species of antediluvian animals.

Another question still remains to be decided. Has the mammoth originally inhabited the countries of the pole, or those of the tropics? The thick hair with which this animal is covered seems to indicate, that it belonged to the

* See Philosophical Magazine, vol. xiv. p. 162. 228. 332.

northern

northern regions;—to this it does not seem reasonable to start objections, although several writers have done so: but what remains inexplicable is, to ascertain, How came the mammoth to be buried in the ice? Perhaps the peninsula of Tumut has been slowly formed. In course of time a general inundation must have covered all the north part of the globe, and caused the death of this animal; which, after having floated for some time among the masses of ice, was finally driven by a gust of wind upon the sand-bank not far from the shore. The sea, upon afterwards retiring within its limits, must have buried the body of the mammoth. But of what use are all these hypotheses, even if they had a high degree of probability?—How can we reconcile facts which seem so contrary? Two years ago similar relics were found in the environs of Kirengsk, upon the banks of the Lena, at a greater distance from the sea, and they had fallen into the bed of the river: others have been found in provinces further south from the Wolga; and they have been discovered in Germany and in Spain. These are just so many incontestable proofs of a general deluge. We must believe that the country of the mammoth was of immense extent: but I shall not at present prosecute inquiries which might lead us into a labyrinth of hypotheses: I shall merely add, that it appears incontestable to me that there has existed a world of a very antient date; and Cuvier, without intending it, gives evident proofs of this in his system, by the twenty-four species of animals, the races of which are extinct. In the mean time I beg the indulgence of the curious reader in the perusal of this essay. I purpose giving the osteology of the mammoth with all that precision which Camper has devoted to a similar work.

MICHAEL ADAMS*.

Petersburgh,
Aug. 20, 1807.

* The author of the above essay offers his skeleton for sale, and means to employ the money it shall produce to him, in a journey towards the north pole, and particularly in visiting the island of Ljachow, or Sichow, which, from information received in his late journey, he believes to be a part of the continent of North America.

XXIV. *Essay*

XXIV. *Essay upon the Art of the Foundry among the Antients: with some Remarks upon the celebrated Horses of Chio, now brought from Venice to Paris. By M.* SEITZ.

[Concluded from p. 29.]

Multiplied Dangers to which the Horses of Chio were exposed at Constantinople, and their subsequent Removal by the Venetians.

WHEN they arrived at Constantinople, by order of Theodosius the younger, that city contained all the wonders of antient art: there were then to be seen the Olympian Jupiter of Phidias, the Venus of Cnidus and of Praxiteles, the figure in honour of Lysippus, and the Juno of Samos, a colossus of an enormous size. If the greater part of the monuments of Rome perished by the ravages which the Goths committed on that city under their generals Alaric, Genseric, and Totila*; the chefs d'œuvre contained in Constantinople were gradually destroyed by fires;—a scourge to which, by a singular fatality, this city was always exposed.

Under the emperor Zeno, who reigned about the year 470 of the vulgar æra, a fire consumed the library and a great number of other buildings: the fire penetrated to the public square, where it destroyed the Juno of Samos, the Minerva of Lindus, and the celebrated Venus of Cnidus†.

In the fifth year of Justinian's reign, the people, inflamed by the extortions practised by this prince, revolted. The emperor introduced into the city the Hellurians, a barbarous people, in order to quell the insurgents. This was the very worst measure he could take, as the war instantly became general; the Barbarians massacred the people, while those

* Winckelman, in a dissertation upon the ruins of Rome, has maintained that it was not the Barbarians who destroyed the monuments of Rome. According to him, Totila pardoned the inhabitants as soon as he entered the city, and endeavoured to conciliate their good will; but it was not until the flames had ravaged Rome for thirteen days, and three-fourths of the city had been so much destroyed that it could never be restored. It was upon ruins, therefore, that he exercised his benevolence, and with the sole view of recalling those inhabitants who fled in order to escape his fury.

† Zonar. *Annales Constantinop.* lib. xiv. p. 55.

who

who remained shut themselves up in their houses, ascended the roofs, and defended themselves with stones and brick-bats: the Barbarians, enraged, set fire to the houses, which were in a short time almost entirely destroyed. A great number of statues were melted, and 40,000 of the inhabitans perished on this occasion*.

Under the emperor Alexius Comnenus, different quarters of the city were devastated by fire and by earthquakes; the colossal statue of Constantine, which was placed upon the grand column of porphyry 110 feet high, was thrown down by a whirlwind, and killed ten persons in its fall†.

The four horses of Chio had fortunately escaped all these fires; but in the great one of 1203, which was the most dreadful that had ever broke out in that city, they were much exposed, because the flames on that occasion attacked the Hippodrome.

When, in the year 1202, the French, under count Baldwin of Flanders, joined with the Venetians in order to undertake the third crusade, and stop the progress of the sultan Saladin, who threatened to take Jerusalem, the son of the emperor Isaac, whom his brother Alexis had imprisoned on usurping the crown, implored the assistance of the crusaders, in order to save his father from the hands of this usurper, and to re-establish him in his lawful rights. The crusaders warmly espoused his interests, and laid siege to Constantinople. The Venetians had already mounted to the assault on the side towards the sea, and had taken possession of five-and-twenty towers, when Alexis marched out of the city to give battle to the French; but although he had an army infinitely more numerous, a panic seized him, and he fled with the greatest part of his treasures. The inhabitants of Constantinople, astonished at his precipitate flight, proceeded to the prison, where the emperor Isaac was detained, and, clothing him in the imperial robes, made obeisance to him. They then opened the gates of the city, and received their young prince with every demonstration of joy. In order to prevent any quarrels between the Grecks

* Zonar. l. c. p. 70.

† Idem, l. c. p. 89.

and

and the allies, the latter were lodged beyond the gate in a place called Stenon. The French, however, freely frequented the city, and the two nations lived in peace and good understanding. The emperor even invited the allies to prolong their stay at Constantinople, as there was a powerful party among the Greeks against him.

During this period, a quarrel arose between the Greeks and the crusaders. The French had forced and pillaged the mosque of the Saracens; the Greeks took part with the latter, and assisted them in revenging themselves upon their adversaries, who, being enraged upon finding they were the weakest, set fire to the city. The flames, increased by the wind, gained ground so rapidly that nothing could stop them. The fire lasted eight days, and occupied the space of a league in circumference. A great number of houses, churches, and convents, fell a prey to the devouring element; among others, the loss of a grand double portico was much deplored, being that of the square of Constantine and the Hippodrome. After this disaster, the good understanding which had subsisted between the Greeks and the French entirely ceased: all foreigners established at Constantinople were obliged to quit the city, to the number of 15,000; the young emperor Alexius became cool towards them, and was extremely slow in executing the treaties, so that war soon recommenced with more fury than before. During the war, the young Alexius was imprisoned, and strangled by order of Marzuflus, one of his ministers, and old Isaac died of grief. The crusaders, when informed of this new catastrophe, assembled in council, declared Marzuflus unworthy to reign, and formed the resolution of redoubling their activity to take the city, and proceed to the election of a new emperor. After several attacks, the city was at last taken a second time on an Easter Monday, 1204. Marzuflus withdrew to the palace Bucoleon, and afterwards fled. The city was given up to plunder, while a new fire burst out, which, according to Villehardoin*, destroyed more houses

* *Histoire de la Conquête de Constantinople, par Godefroid de Villehardoin*, Marechal de Champagne et de Romanie, p. 132.

than

than the largest cities in France at that time contained. The booty, which according to the various conventions was to be divided equally, was so great that it filled three churches; and although a great part was embezzled, it was shared to the value of 400,000 marks silver. After having plundered the living, and profaned the altars, the ashes of the dead were even molested. All the tombs of the emperors were opened, in order to rob them of whatever was precious. At last, when the avarice of the crusaders found no more encouragement, their fury was directed against the statues, which they demolished, either in order to send them to the mint, or to sell them to the founders, who paid the value of the metal only*.

Among these works are enumerated the following:

A colossal Juno, the head of which alone could scarcely be moved by eight oxen.

A Paris presenting the apple to Venus.

A large square monument of bronze, surmounted by a pyramid. In this were represented the labours of the field; lambs frisking to the sound of the shepherd's pipe, the catching of birds, and fishing; Cupids throwing apples, &c.

An equestrian statue in heroic costume, which was in the bullock market: to all appearance it was that of an emperor; but the inscription was lost: some said it was Joshua stretching out his hand to the setting sun, and ordering it to stop: according to others, it was Bellerophon †.

Among the statues which decorated the Hippodrome, they melted down a colossal Hercules in a sitting posture, and full of grief for having killed his children ‡: so large was this figure, that its thumb equalled in size the body of a man.

* See Nicetæ Coniatæ *Narratio de Statuis* Constantinop. in Fabricius *Biblioth. Græc.* tom. vi. p. 405.—*Note by the Author.*

Part of the above work has been translated by Harris, in his Philological Enquiries, vol. ii. p. 301, chap. 5. This work was translated into French by M. Boulard, who was pleased to give it the title of *Histoire literaire du moyen Age*.—*Note by M. Millin.*

† On the subject of the losses to the arts sustained at Constantinople, we may consult M. Heyne's dissertation *De Interitu Operum cum antiquæ tum recentioris Artis quæ Constantinopoli fuisse memorantur, ejusque Causis ac Temporibus.* Memoires de Göttingen, tom. xii. p. 273.—*Note by M. Millin.*

‡ Euripidis *Hercules furens.*

The ass with his driver, erected by Augustus at Nicopolis*.

The wolf which suckled Romulus and Remus.

A man combating a lion.

A hippopotamus of bronze.

An elephant with a moveable trunk.

Sphinxes, represented in the attitude of birds flapping their wings, as if previous to flying upwards.

A horse, full of ardour, and burning to start into the arena.

A Scylla, or female monster, devouring the companions of Ulysses.

An eagle stretching its wings, in order to carry off a serpent which he held in his claws: upon its wings were seen lines and cyphers, which served for a sun-dial.

A Helen: her tunic, wrought with the utmost beauty, showed the fine shape of her limbs:—a magnificent diadem confined her hair, which fell in ringlets on her shoulders: her languishing eyes, the soft smile of which dwelt upon her lips, half open; her raised and arched eyelids—every feature, in short, conspired to present a degree of perfection and beauty of which no description can give any idea.

Several charioteers, represented in the different attitudes peculiar to their occupation. They were placed at the eastern goal (*meta*) of the Circus, which was called that of the red faction.

A combat between an ox, a hippopotamus, and a crocodile:—each of the combatants was biting his adversaries; the victory seemed to lean to no side, and it was evident that the death of all three would finish the combat.

All these and many other chefs d'œuvre were thrown into the flames. This fact alone evinces the barbarism in which the people of the Western Empire were as yet plunged:—the horses of Chio, however, escaped the destruction. History has not preserved to us the name of him who exerted his influence to save them; but it is very probable, that by order of Dandolo, the doge and general of the Venetians†, they were

* Sueton. in Octavio, cap. 96.

† The Venetians were, for a long period, united with the Greek empire: their merchants had counting-houses at Constantinople, and the doge himself had

were reserved for the republic when the booty was shared, although their removal to Venice did not take place until after the death of this enlightened doge. The first vessels which set out, only carried the precious vases and ornaments of which the church of Saint Sophia had been stripped, with a great quantity of relics, among which there was a flask filled with the blood of Jesus Christ.

After the death of Dandolo, which happened in 1205, Peter Ziani was elected doge of Venice; and the Venetians who were at Constantinople elected as their chief Martin Zeno, by the title of Protesta. He had the charge of the administration of all the provinces, which by the new partition had fallen to the republic, and the diplomatic affairs were expedited in the joint names of the emperor Henry, successor to Baldwin, and Zeno the Protesta. It was the latter who sent the four horses of Chio to Venice, with several precious works in porphyry and marble.

Peter Ziani, the successor to Dandolo in his dignity of doge, adorned the portal of the church of Saint Mark with them, where they remained until 1798, when the emperor Napoleon brought them to Paris as an ornament of his capital, and the trophy of his victories.

Upon the alleged Defects in the Casting which have been discovered in these Horses—Answer to Winckelman—and Conclusion.

The repairs made after the casting, which are to be seen

had a palace there. The inhabitants of Pisa and the Venetians engrossed the commerce of the Levant, which gave them the superiority over all the European nations, as well in riches as in mental acquirements. Henry Dandolo joined to the talents of a good general and a sage politician a most extensive knowledge of the world. When Innocent III. excommunicated the crusaders on account of the taking of Zara, the French leaders, who were all spirited and brave knights, but who could neither read nor write, feared the effects of the anathema, and consented to all the conditions which the bishop of Soissons, as authorised by the pope, prescribed to them before he gave them absolution; while Dandolo, with his Venetians, constantly refused to acknowledge the authority of the pope in temporal affairs, and braved the anathema. Vide Laugier's Histoire de la République de Venise, tom. ii.

in the engravings of Zanetti*, are a necessary consequence of the manner in which the antients proceeded to cast their metals. All the bronze statues from Herculaneum exhibit similar repairs. Pliny says†, that the first statues erected to the conquerors in the Olympic games, were modelled upon their own persons, and that these statues were called Iconic, but they were cast solid. Afterwards the art was improved upon, in order to produce the same effect with less metal, and they were cast hollow. Thus, by degrees, succeeded the sure but slow and expensive method at present adopted.

M. Boufferand‡ says, that the antients did not take the trouble of making the first model of plaster, and then cast the mould; but that, after having made their model of the full size with prepared potters' clay, they reduced it piece-meal to a smaller size, and then dipped it into the melted bronze, so that their model thus became a kind of nucleus§.

Hitherto the observations of M. Boufferand have been

* Statue di Venezia, tom. i. pl. 45.

† Lib. xxxiv. cap. 4. sect. 9, *ex membris eorum similitudine expressas.*

A Genius, of Etruscan bronze, to be seen in the Florence cabinet, is wrought so naturally, that sculptors and painters think the mould must have been made upon the body of a young man. Vide Gori, *Mus. Florent.* pl. 45; et *Museum Etruscum*, pl. 87.

‡ Vide Encyc. des Arts et Metiers.

§ According to Philo Byzantius, *De Septem Orbis Miraculis*, cap. v. p. 13, the antients never made any large statue at a single jet, but they melted the parts separately, and joined them afterwards, according to the model they had previously made. *Simulacra artifices primum fingunt, deinde membra divisa conflant, tandem omnia bene composita erigunt.* But this assertion seems to be denied by Pausanias, who, speaking of Rhœcus and Theodorus, says, αγαλματα δια παντος επισταντο εργασασθαι καθαπιες εσθητα εξυφαινοντες: they knew how to work entire statues like a dress wrought without a seam: a singular expression, but which has been mistaken by translators for statues cast at a single jet. According to the same Philo, the famous Colossus of Rhodes was also cast in parts, but in another way:—they began by casting the legs, then placed them on the ground, melted the thighs above them, and proceeded upwards in such a manner that the hot metal united itself with the cold. This method of proceeding perhaps explains what Pausanias means by εξυφαινοντες. The antients were afraid, that by melting large masses at a single cast, the flux might cool in flowing along. Recent experiments have taught us, however, that it will run forty feet before becoming fixed. It is therefore probable, that if we had the same taste for Colossi that the antients had, we should be able to cast them with still more perfection.

just

just and general; but when he continues to say that they covered the nucleus with wax, and made upon this wax putty moulds, and then finished the work like ourselves, we can state in opposition to this, that wax never has been employed in casting the horses of Venice, nor in any other antique bronzes, where we see pieces hammered into them in order to fill the holes which remained after founding. This defect proceeds from the total absence of wax, which is now made to occupy the space which should be filled by the bronze, and forms the thickness wished to be given to it between the nucleus and the hollow mould, a space which remains void when the wax is melted, and which is filled by the casting, the continuity of which is not interrupted by any obstacle.

If the modern process of founding is more perfect, that of the antients was more expeditious and much less expensive *. After having finished their model, they formed the hollow mould upon it; and in making the mould the different pieces were so joined, that each side of the figure was covered with its proper parts, so as to make two half moulds, adapted throughout their whole length, and the two edges of which joined upon the horses' backs through their whole length, and under the belly in the same manner. At least this observation applies with respect to the horses of Venice, and the moulds of their feet seem to have been made separately. After having finished this part of the process, they diminished the model until they brought it to suit the thickness they wished to give to the metal, and by this operation they formed the nucleus. But this diminution could not be made throughout the whole surface; some plugs must have been left interposed, to hinder the moulds from falling upon the nucleus, and in order to remove them

* All the French founders assembled together, says Winckelman, would not be able in ten years to finish the three hundred and sixty statues made at Athens for Demetrius Phalereus in 300 days. But, according to their manner of operating, the Athenians had no occasion to break the mould in order to draw out the statue, and the same moulds perhaps served several times. How could Lysippus have executed 610 works, according to Pliny, if he did not know how to abridge the labours of the foundry?

to the proper distance wanted for the thickness of the metal. Many of these plugs would be necessary as supports, in order to keep the mould steady, and hinder the nucleus from leaving its place. This being done, they added the moulds of the feet; when the whole was fired, and the founding proceeded in. The founding being finished, these plugs formed so many holes in the metal; but they were made use of in digging out the nucleus or core in pieces, by means of sharp-pointed irons. Every thing being finished, they filled all the holes with plates of copper, hammered and fitted to the openings; and riveted by nails as we see in the horses of Chio, and the bronze statues of Herculaneum.

It would be rash, however, to maintain that this custom was general in all antient works of art; with respect to more recent periods, the observation of M. Boufferand may apply. The art of founding flourished in the empire of the East. We find in Zonarus that they erected to almost all the emperors of the East bronze statues at Constantinople: and an epigram * of the poet Juvenal, who was contemporary with Theodosius, proves that wax was employed in the statues of that time.

Winckelman † complains much of the manner in which the horses of Venice raise their feet. He says, "Some people assert that horses lift the two feet of one side at one and the same time, and such is the gait of the four horses of Venice." It is evident, however, that Winckelman is mistaken; all the art of Franconi the equestrian would be incapable of making a horse move in this manner.

A horse, when at the gallop, raises his two fore feet at once, and follows by the two hind feet, lifting them one after another, which produces three distinct motions.

A horse, when at a walking pace, moves at four different times, in a diagonal line, or in a cross; that is to say, after having lifted the right fore foot, he lifts the left hind foot, all which is conformable to the laws of mechanism; and this is the gait of the horses of Venice, and of that of Marcus Aurelius in the Capitol.

* Anthol. lib. iv. † Liv. v. ch. 6, § 16.

A horse,

A horse, when trotting, lifts at the same time the right fore foot and the left hind foot, which makes a double beating.

We see these three kinds of movements upon medals and bas-reliefs; but statues which require a support of three feet are susceptible only of the second.

After the restoration of letters the art of founding re-appeared in Italy in the time of the Medici. The painter Andre Verrochio was the first who imagined that the antients made a hollow mould upon a statue, or even upon a dead or living subject, in order to form an exact resemblance. This invention naturally inspired him with the idea of using a similar mould for melting a bronze statue: he succeeded, and exercised the art of founding in the manner of the antients, *i. e.* by casting the parts separately and joining them afterwards by soldering. He undertook an equestrian statue of a Venetian general to be executed in this way. But he finished the horse only, having died of a malady contracted from his zeal to execute the work with fidelity. After this, John of Boulogne made use of the same method for casting the equestrian statue of Cosmo de Medicis at Florence.

About the year 1500, Pomponius Gauricus * printed at Naples a treatise upon sculpture, in which he described the ingenious method of proceeding made use of at present for melting equestrian statues at a single cast. He adds in the conclusion, that this science having perished with those who had formerly known and practised it, he thinks he is entitled to assume to himself the merit of the invention †.

Since

* Pomponii Gaurici Neapolitani, *De Sculpturâ Liber ad Herculem Ferrariæ Principem; in Thesauro Gronovii*, vol. 9. pag. 781.

† In the time of Gauricus, when few of the Greek authors were as yet printed, it was sufficient to be acquainted with the Greek language in order to qualify a person for being an inventor, and to pass as such in the eyes of the vulgar. They even went so far as to destroy the manuscript, that the plagiarism might never be discovered. A great number of inventions supposed to be modern have been derived from the antients.

In clock-work, nothing is modern except the pendulum; all the wheelwork necessary for putting in motion the indexes of a dial is described in Vitruvius. He also speaks of a kind of sounding machine, which threw a certain num-

Since this period we have seen similar monuments erected at Pisa, Placentia, Leghorn, Ferrara, Milan, Venice, and in the Papal states. Several cities of Germany and Holland perpetuated in this manner the memory of their benefactors; and in 1622 the city of Rotterdam erected a bronze statue to the famous Erasmus, the only modern scholar who obtained such an honour.

ber of stones in order to mark the hours. Water-mills, organs with all their keys and interior mechanism, were known in the time of Augustus: it is true that water was employed for keeping up a continual wind; but it would seem this method was soon relinquished, and the same effect produced by means of several pairs of bellows:—an epigram of the emperor Julian upon organs and organists of his time mentions it.

The system of Copernicus is the system of Pythagoras, or rather that of the antient Chaldees, who, without any other assistance than their eyes, had already seen the rotation of the earth around its axis; and all the discoveries to which the telescope and the perfection of mathematical instruments have given rise, are so many proofs of the truth of the antient system. Lastly, the decomposition of light by the prism, upon which the great Newton formed his theory of colours, is to be found in Seneca.—Questions, book i. ch. 7.

If we have gunpowder, the antients had their Greek fire, the effects of which were terrible. in the reign of Louis XV., an inhabitant of Dauphiny, of the name of Dupré, who had spent his life in chemical experiments, recovered the secret. This fire was so rapid and so powerful that no art could extinguish it; water only gave it additional activity. Experiments were made with it on the canal at Versailles in presence of the king, in the arsenal at Paris, and at some sea-ports: every where the most intrepid military men trembled at its effects. The king, who wished to avert this new scourge from humanity, forbid the author to communicate his secret to any one, and rewarded him liberally. Dupré is no more, and it is thought his dreadful secret died with him.

Nothing proves the superiority of the antient inventions more powerfully than the five orders of architecture. Modern architects hardly venture to make the least change in the system: it is well known that the finest buildings are those in which these orders reign in their greatest purity. When will a second Callimachus appear to invent a new order? These men of genius, who have really extended the circle of human knowledge, are separated by the interval of ages, and there is nothing more humiliating to the human mind than the slow progress of its attainments. It is true, we speak at present of new inventions as of new fashions: there is not a single mechanic in Paris who does not pretend that he has enriched his trade with some invention: but all these inventors resemble the modern grammarian, who announced discoveries in the Latin language.

It must be confessed, however, that these joint efforts may produce some good effects, and that they are worthy of recompense and encouragements from government.

The first monument of this kind erected in France was the statue of Henry IV.; the horse was cast at Florence by John of Boulogne: Cosmo II., the grand duke of Tuscany, presented it to Mary of Medicis, queen of France, and at that time regent; she destined it to consecrate the memory of the king her husband, whose statue was executed by Dupré the sculptor by her orders. It was erected in 1635.

A short time afterwards cardinal Richelieu erected the equestrian statue of Louis XIII. in the Place Royale. The horse was executed in Tuscany by Ricciarelli de Volterre, a pupil of Michael Angelo, and was regarded by some as a superior work, and by others as a middling production. The statue of the king was executed by Biard.

The age of Louis XIV. was so brilliant for the arts, that the splendour of the Augustan age, so much boasted of, is nearly eclipsed by the comparison.

The art of founding declined under Augustus; and the reports of Pliny and Vitruvius, both upon the taste then reigning in painting, and upon the method of the painters in their days, must give us a very unfavourable idea of their talents, while the names of Girardon, Desjardins, Bouchardon, Lemoine, Paget, Lebrun, Lesueur, Bourdon, Mignard, Jouvenet, &c., have been the glory of their age, and the admiration of every country where their works have penetrated.

The statue of Louis XIV. in the Place des Victoires, by Des-jardins, and the equestrian statue of the same prince in the Place Vendôme, by Girardon, were unique performances, with respect to beauty of design and the elegance and magnificence of the appendages. The cities of Lyons, Rennes, Dijon, Montpelier, Bourdeaux, and Metz, were necessarily adorned with statues of this prince, and of his successor; but the revolution of the 18th century was equally fatal to all these works as was the invasion of Attila to the bronzes of Rome, and the fanaticism of the crusaders to those of Constantinople.

France, which produced the talents that decorated the other cities of Europe, is, however, stripped of these chefs-d'œuvre, which formerly formed the ornaments of her public places.

It will not be difficult, however, to replace them. Paris still contains some very distinguished artists in bronze. In the recent exhibitions of the objects of French industry, bronzes have formed an interesting article.

The exploits of our warriors, and of our august chief, have furnished them with subjects worthy of decorating the public places of Paris and the other cities of France, while the immense quantity of cannon taken from the enemy will supply the materials.

XXV. *On the Making of Starch. By Mr.* James Graham, *of Berwick-upon-Tweed* *.

Starch may be made from a variety of articles:—potatoes, in particular, will yield a considerable quantity; but the great labour attending grinding or grating them down has hitherto prevented any great quantity of starch being made from that vegetable. When the potatoes are grated down, they do not require to be laid in steep to ferment after the manner of flour, but must be immediately strained through a sieve; and if the potatoes are of a good quality, the starch will settle to the bottom almost instantly: indeed the operation of straining after the potatoes are grated down cannot be performed too quickly. The produce, however, even from the best, is far less than most people would imagine; the best potatoes I ever used only produced 4 or $4\frac{1}{2}$ stones of starch from 40 stones of potatoes.

Potatoe starch is not saleable in the shops, not having so long and firm a grain as starch from flour; but if properly made is preferable to all others for blue-makers, as it melts or dissolves so easily, and incorporates with the colour with far less trouble than any other substance whatever.

When starch is made from flour, the wheat is not ground so small as when intended for sale, but ground with a broader flag or bran, as the meal and starch are found to separate more readily from the bran. When laid in to steep as much water must be used as to wet completely the whole meal; in three, four, or five days it will ferment, and in

* Communicated by Mr. John Clennell.

a few

a few days more will settle, and all fermentation cease: after this the stuff is fit to be what is called washed out.

The common time allowed to steep is fourteen or twenty days: as much depends on the temperature of the weather, the exact time cannot be ascertained; but it is much better to lie a few days longer than to be washed out one day too soon. This operation is performed by the stuff being taken from the vats and put into a strong round basket, which is set across a tub below a pump: one or two men keep going round the basket stirring up the stuff with strong wooden shovels called stirrers, while another keeps pumping water till all the meal is completely washed from the bran, which is emptied into some convenient place to feed hogs: this operation is continued till the vats are emptied of the whole stuff, at the same time that it is strained through the basket into the tub underneath. As fast as the tub fills, it is taken out and strained through hair sieves into what are sometimes called squares, by others frames. It is then suffered to rest twenty-four hours, when the water is drawn off the frame by plugs fixed at different depths. A thin stuff is then found to float above the starch, which is taken off by a tray made of a particular form for that purpose: this is called slimes, and is put into a cistern to feed hogs, by being mixed with the bran or grains: fresh water is then pumped into the squares, and the whole is wrought up with the stirrers till it is completely incorporated with the water; it is then strained through a fine silk sieve, and suffered to rest and settle twenty-four hours, when the water is again drawn off, and some more slimes will be found floating, or at least in a loose and unsettled state, on the top of the starch; which being carefully removed, fresh water is again pumped on the starch, and the whole is again wrought up as before; when it is again put through the silk sieve. It is now suffered to rest for some days,—say four or five,—till the starch is again settled in a very firm state at the bottom of the square. It is necessary to observe, if the starch is wanted to be what is commonly called Poland, that is, with the blue shade; during the last time of putting through the silk sieve, a certain quan-

tity of the very best smalts must be mixed with the starch. If the smalts are very good, 2lb. per cwt. may do, and sometimes 3lb., according to the depth of blue wanted: if the best smalts are not used, however fine the colour may appear when in a damp state, it will entirely fly off in the stove, and leave the starch of a dingey hue.

When the starch is found to be completely settled, the water is again drawn off; and if any more slimes are still on the top they are taken off as before, and the starch is now fit for boxing. It is necessary to observe, that the slimes taken off after the starch has been put through the silk sieve are not put into the hog-wash, but are either mixed with some other operation, or again wrought up with water and strained through the silk sieve; when a considerable part of them will be tolerably good starch.

The boxes may be made of different sizes; but they are commonly about four feet long, six inches deep, and twelve inches broad, and are bored full of holes, so that any remaining water may drain from the starch. Thin canvass is cut in such length and breadth as to line all the inside of the box, the intention of which is to bring the starch clean from the box after the water is fully drained.

The boxing is performed by digging the starch out of the square with a spade or shovel, and filling the boxes. The length of time for the starch being in the boxes can only be ascertained by the starch coming to a hard solid body, which is sometimes sooner and sometimes longer. The starch is then taken from the boxes by turning them bottom uppermost on a table or dresser; it is then broken into pieces about four or five inches square, by laying a ruler or round piece of wood underneath the starch, giving the upper side a cut across with a knife; when a small press of the hand will break the starch into such pieces as are designed.

It is then set upon soft bricks, that is, bricks which have been only half-burned in the kiln: the intention of this is to suck the water out of the starch; which if not done before it is put into the stove, it is apt to dry into various hard substances called hamy, which will not melt when it comes

to

to be used; so that it will not answer for blue-makers, nor for the purpose of the laundry.

When sufficiently dried on the bricks it is put into the stove, (which is nearly the same as a sugar-baker's,) where it remains some time: the duration must depend on the judgment of the maker, and the degree of heat in the stove. It is then taken out and set on a table or dresser, when all the sides are carefully scraped or pared with a thin knife; after which, it is tied up in paper the same as we see it in the shops; when it is again returned into the stove, and continued with a regular heat night and day till completely dry: it requires some days, but the length of time can only be ascertained by an experienced maker.

It may be necessary to observe, that from the first laying in the meal to steep, till the last operation of taking from the stove to be weighed, the manufacture is constantly under the survey of one or more officers of excise.

XXVI. *Report of Surgical Cases in the Finsbury Dispensary from the Beginning of May to the End of June* 1807, *with the Appearances on Dissection in a Case of Hydrocephalus. By* JOHN TAUNTON, *Esq.*

DURING the above two months, there were admitted 187 patients,

Cured or relieved - -	135
Under cure - - -	52
	187

Miss M., æt. 5., of a delicate constitution, predisposed to scrophula, had a purulent discharge from the right ear for three years preceding her death: it took place subsequent to the Measles, and was generally copious, for the most part VERY OFFENSIVE, and frequently attended with pains in the head and ear, but in other respects she was LIVELY and HEALTHY.

Two days previous to the 21st of October 1806, she complained

plained of a giddiness in her head, which prevented her from walking across the floor without danger of falling; she was sick and vomited occasionally, had fever, and the bowels were costive; her eyes were not directed to the same focus. The family physician was now consulted, who prescribed a calomel pill and some infus. rosæ: the symptoms continued with little variation for 7 days, (during which time the accustomed discharge from the ear had ceased,) when a swelling was observed below the ear, which being poulticed soon broke, and all the symptoms gradually disappeared, so that from the 30th of October to the 19th of November no medical attendance was required. She was then seized with violent pain in the head, had occasionally startings with rigor, which terminated in convulsive fits of short duration: between these paroxysms, which were irregular, she was *perfectly* SENSIBLE and *quite easy*. A large blister was applied to the head, fomentations were used, and purging clysters were injected; but these did not avert the symptoms:—she died on the 23d.

On removing the upper part of the scull, the membranes of the brain and the cerebrum were perfectly natural and healthy: the lateral ventricles contained about four ounces of a serous fluid: the right lobe of the cerebellum was more dark than usual, and flabby; on cutting into its substance an abscess was found which contained about an ounce of purulent matter; the dura mater was ulcerated at the posterior part of the petrous portion of the temporal bone, or round the internal auditory foramen; where the bone had become carious, the membrana tympani and small bones of the ear were destroyed, and a probe could be passed with ease from the internal through the external auditory foramen.

The sutures of the scull being completely closed, the brain must have been compressed from the accumulation of fluid in the lateral ventricles, which probably took place about the 21st of October: it must also have suffered from the abscess which had destroyed the right lobe of the cerebellum, and which there is reason to believe had existed for years; yet we find the reasoning faculty was

continued and perfect even to the day of her death, excepting the short periods of pain, rigor, and convulsive fits.

JOHN TAUNTON,
Surgeon to the City and Finsbury Dispensaries, Lecturer on Anatomy, Surgery, Physiology, &c.

Greville-street, Hatton garden,
November 20, 1807.

XXVII. *Notices respecting New Books.*

Chemical Philosophy, or the established Bases [Basis] *of Modern Chemistry, intended to serve as an Elementary Work for the Study of that Science, by* A. F. FOURCROY, *Professor of Chemistry, Member of the National Institute, &c. Third Edition, considerably enlarged and amended. Translated from the French by* W. DESMOND, *Esq.* 304 Pages. 8vo. 7s. Symonds, 1807.

THE celebrity of M. Fourcroy, and the general merit of his Treatise on Chemical Philosophy, are more than sufficient to sanction a translation of it into English. Any work, indeed, by the man not altogether undeservedly called *l'Orateur de Science*, must merit attention. But as philosophy acknowledges no master, no authority but what exists in the nature of things, we may safely venture to examine and compare the contents of a small volume, which assumes the sounding title of "Chemical Philosophy." Respect for the science renders us eager to avail ourselves of every opportunity of presenting all or any of its branches in a new, more advantageous, or clearer point of view: the same motive constitutes it a duty to detect and expose any works which, under plausible titles, tend more to embarrass, perplex, and retard the progress of chemical science, than to facilitate the acquirement, extension, or elucidation of its principles. Without objecting to M. Fourcroy's implied opinion, that a "classification of the phænomena of nature and art constitutes chemical philosophy," however vague and indefinite it may be, we cannot perceive either the justness

ness or the propriety of entitling a work "Chemical Philosophy," in which there is no notice of pneumatic chemistry, no classification or description of the qualities and characters of gaseous bodies. A number of general results, arranged in the form of corollaries, with some regard indeed to their general relations, should rather be denominated a concise view of *practical* chemistry, than the philosophy of chemical science. This error, however considerable, as it conveys a false idea of the nature and object of this treatise, we should not particularly notice, were it not followed by several others of a similar origin, but still more injurious to the general perspicuity and accuracy of our chemical knowledge. Such errors are the more extraordinary and the more dangerous, that the author boasts of the "numerous corrections and important additions" which he has been enabled to make in this third edition, which, he presumes, from the "reception it has experienced in *all* enlightened countries, may be ranked with classic books." He says it has been "translated into German, Swedish, Danish, English, Spanish, Portuguese, Italian, and modern Greek;" but no mention is made of Dutch and Russian. The chief additions consist of an introduction, divided into 100 sections, occupying 66 pages of this translation. It presents a view, much more extensive than accurate, of the nature and "general means of chemistry, principles of bodies, attraction of aggregation and composition, chemical operations by means of fire or liquids, and the classification of bodies."

The very first section of this introduction consists of two propositions, neither of which is philosophically correct. "The especial object of chemical philosophy," says M. Fourcroy: "is, 1st. to apply the general theory of chemistry to the phænomena of nature and to the operations of art, the cause and effects of which are entirely within the province of this science." This is certainly the inverse object of true "Chemical Philosophy," which, since the days of Bacon, has been first to unfold the phænomena of nature which exist and are cognisable independent of all theory, and next to develop the relations of these phænomena, so that the observer

observer may arrange them in classes, genera, and species, whence results a general theory. On the accuracy of such arrangements depends all the merit of the respective theories of natural phænomena which have hitherto amused mankind. To begin the study of chemistry, which is a science of experience and observation, by applying any artificial theory or system to explain natural phænomena, is surely to contemplate nature under the veil of art. By such means, it is true, a system may be consolidated, but our knowledge of the œconomy of nature will never advance one step nearer truth. The second proposition is remarkable for a copiousness of not the most appropriate terms. "To show the *connections* existing between these phænomena and their *reciprocal influence* upon each other, we must consider this philosophy as comprising the whole of the important discoveries made by chemistry." The "connections" and "reciprocal influence" of phænomena are not unfrequently identical terms, and even the analogies of chemical bodies are often discovered or known only by their reciprocal influence on each other.

M. Fourcroy, after taking a poetical view of the progressive mutations of all bodies, reduces the objects of his consideration to eight articles, "which really constitute the first principles or elementary basis of chemistry." They are as follow: "1st, Definition of chemistry; 2dly, Examination of its general means; 3dly, Chemical nature of bodies; 4thly, Attraction of aggregation; 5thly, Attraction of composition; 6thly, Chemical operations; 7thly, Classification of natural bodies; and 8thly, Chemical phænomena of nature, and their classification." These articles are again divided and subdivided with tedious minuteness, and interlarded with fanciful or erroneous distinctions, which may bewilder, but certainly cannot assist young students of chemical science. For instance, although it is acknowledged that "analysis is a division very different from that performed by mechanical instruments;" the author makes a subsection of "mechanical analysis (a solecism), spontaneous analysis (more properly decomposition), analysis by fire, and by re-agents." Again we have the division of "immediate

"immediate or proximate analysis (another name for what he calls *mechanical* analysis, which consists in expression, trituration or washing *preparatory* to an analysis), mediate or remote analysis, true or simple analysis, and false or complex analysis." These, however, are not all; there are still "mineral analysis, vegetable analysis, animal analysis," &c. &c. to be discussed. Will it be pretended that such futile, not to say erroneous, distinctions can either be necessary or useful to the perspicuity, precision or elucidation of chemical philosophy? In general the briefest is the most clear definition, but there is neither brevity nor perspicuity in such pedantic distinctions. In the next article, on the "attraction of aggregation," we have "solid, *soft*, liquid and elastic fluid, aggregates." These are followed by "*particulary* attraction," (as Mr. Desmond translates it) and "*molecular* attraction." Several sections are occupied in announcing the well known fact, that on our acquaintance with the operations of the affinities depends all our knowledge of the theory and practice of chemistry. The description of the different chemical operations, indeed, such as calcination, evaporation, &c., is much more accurate and precise.

But the great merit of this "chemical philosophy," in the estimation of its author, is the "classification of bodies," in which, he tells us, "after many long attempts in searching for the distinction of bodies, he has fixed upon a method which divides all beings into eight grand classes, agreeable to their characteristic compositions." These classes are: "1st, Simple or indecomposable bodies; 2dly, Binary compound deflagrated bodies (here translated, binary *burned* bodies); 3dly, Salifiable bases; 4thly, Saline substances; 5thly, Metallic substances; 6thly, Mineral or fossil compounds; 7thly, Vegetable compounds; and 8thly, Animal compounds." In this arrangement there is nothing novel or peculiar. The following is the author's classification of the chemical phænomena of nature, which consists of a series of twelve sections: "1st, Action of light; 2dly, Action of caloric; 3dly, Action of air; 4thly, Nature and properties of combustible bodies; 5thly, Nature and

and action of water; 6thly, Formation and classification of acids; 7thly, Properties of salifiable bases; 8thly, Union of acids with salifiable bases; 9thly, Oxydation and dissolution of metals; 10thly, Nature and formation of vegetable compounds; 11thly, Passage of vegetable compounds to the state of animal compounds; nature of the latter; and 12thly, Spontaneous decomposition of vegetable and animal compounds." These twelve sections form the chief divisions of this chemical philosophy, which the author, in a tone of self-gratulation that has but little affinity with the true spirit of philosophy, assures us, "notwithstanding the shortness of the work, really embraces the whole extent of the science; makes known all its branches, presents all its principles, and conveys, at the same time, the most general and most *accurate* notions of it!!" M. Fourcroy, in common with many other authors, here asserts that vegetables are capable of effecting "a real decombustion" of the air, and that their leaves exposed to the rays of the sun "shed into the atmosphere a torrent of oxygen gas." Ellis has sufficiently confuted these notions. (See Phil. Mag. vol. xxviii. p. 273.) The following table exhibits the author's improved classification of the acids.

TABLE OF ACIDS.

Classes.	Genera.	Species.	Characters of the Species.
1st Class. Acids with simple and known radicals. Twelve species.		Carbonic acid.	Product of the combustion of charcoal, gaseous, mephitic, nearly inodorous, the most feeble and most indecomposable of acids.
		Phosphoric acid.	Formed by phosphorus rapidly burned, very heavy, vitrifiable, very sour, not caustic, yielding phosphorus with red charcoal.
		Phosphorous acid.	Less oxygenated, more phosphorated than the preceding, yielding a white smoke and a phosphoric flame, by heat.
		Sulfuric acid.	Sulphur totally burned, acrid, caustic, inodorous, charring organic compounds, very heavy, yielding sulphur with red charcoal.
		Sulfureous acid.	Odorous, gaseous, irritant, like sulphur, burning blue discolouring and whitening vegetal and animal colours
		Nitric acid.	One of the most decomposable, and therefore most variable in nature; by losing some oxygen it passes, 1st. to the state of nitrous gas or azotic oxyd, insoluble in water, and reddening by the contact of air; 2d. to the state of azotic oxydule gas, soluble in water, not reddening in air, inflames charcoal, phosphorus, sulphur, oils, and some metals, destroys animal miasmata, and disinfects the most infected places.
		Nitrous acid.	It is nitric acid holding nitrous acid in solution; nearly absorbs its weight from it; then in a rutilant vapour more volatile than nitric acid.
		Arsenic acid.	Solid, fixed, vitrifiable, very poisonous, inodorous, arsenic completely burned.
		Arsenious acid.	Solid, volatile, odorous, and garlic-like when in vapour.
		Tungstic acid.	White, pulverulent, rough, growing yellow by nitric and muriatic acids.
		Molybdic acid.	Rough, little soluble, in white threads, becoming blue when deprived of oxygen.
		Chromic acid.	Yellow, little soluble, forming yellow, red, or orange coloured salts.

TABLE OF ACIDS CONTINUED.

Classes.	Genera.	Species.	Characters of the Species.
2d Class. Acids with unknown radicals but presumed simple. Four species.		Muriatic.	Gaseous, indecomposable, odorous, forming a white vapour, depriving many bodies of oxygen.
		Oxygenated muriatic.	Greenish-yellow gas, fetid, thickening liquids and contracting animal organs, inflaming many combustibles, destroying almost all colours.
		Fluoric.	Gaseous, pungent, dissolving glass and silex, of which it precipitates a part by water.
		Boracic.	Solid, in crystalline spangles, fixed and fusible into glass, little soluble, little sapid, very feeble in its combinations.
3d Class. Acids with binary radicals. Twelve species.	1st Genus. Pure vegetal acids.	Succinic.	
		Millitic.	
		Citric.	
		Malic.	
		Gallic.	
		Benzoïc.	
	2d Genus. Vegetal acidules.	Tartarous.	
		Oxalic.	
	3d Genus. Factitious acids.	Camphoric.	
		Suberic.	
		Mucous.	
	4th Genus. Fermented acids.	Acetic.	
4th Class. Acids with ternary radicals. Four species.		Amnic.	
		Sebacic.	
		Uric.	
		Prussic.	
Acids falsely admitted as particular acids, but found to belong to acetic acid.		Pyromucous.	
		Pyrotartarous.	
		Pyroligneous.	
		Ciceric.	
		Acetous.	
		Formic.	
		Bombic.	
		Cruoric.	
		Zoonic.	
		Lactic.	

These

These 32 acids form as many genera of salts, which contain about 380 species, each of which should be profoundly studied. Every earthy or alkaline salt may be considered under the following aspects:

"1st. The form, and the varieties of that form: it must be described geometrically; the inclination and degrees of the angles must be stated, as well as the primitive formation of the crystals, their interior form, their dissection, and the laws of decrement which determine their varieties. 2d. Its existence in nature or in art; the comparison of the natural with the artificial salt. 3d. Its savour. 4th. The action of fire, whether null, dissolving, vitrifying, subliming, decomposing, &c. 5th. The action of light. 6th. The influence of air, whether null, giving or taking away water to or from the crystals. 7th. Its union with water, the quantity necessary to effect a dissolution at the various temperatures, the caloric absorbed or disengaged; the crystallization performed by refrigeration or evaporation. 8th. The attraction of the earths which modify or decompose, or do not change the salt, or which unite with it in a trisule. 9th. The effect of alkalis on it, whether null or decomposing, sometimes uniting in a triple salt. 10th. The comparative action of different acids upon that contained in the salt, decomposing it, changing its nature, or producing no effect upon it. 11th. The influence of other salts upon it; whether reduced to nothing, or to an entire action tending to form a triple salt, or to a double decomposition, changing the acids and the bases, or into a precipitation in proportion to their attraction for water. 12th. The dissolubility or indissolubility of the salt in alcohol. 13th. Its alteration or inalterability by charcoal, decomposing its acid, or leaving it untouched. 14th. The influence of vegetation and of fermentation on the salt. 15th. Finally, its action on animal œconomy."

The properties of metallic salts of importance to be known are the following:

"1st. Form and varieties. 2d. Savour and causticity, greater or less. 3d. Alteration by light. 4th. Fusion, desiccation, decomposition more or less distinct by caloric. 5th. Deliquescence, efflorescence, or more or less complete decomposition

decomposition by air. 6th. Dissolubility in water hot or cold: decomposition more or less advanced by pure water, or water aërated. 7th. Decomposition by alkalis and earths; nature of precipitated metallic oxyds; complete precipitation, or formation of triple salts or trisules, partly alkaline or earthy, and partly metallic. 8th. Alteration of metallic oxyds at the moment of their precipitation, whether by air, or by the nature of the alkali employed to precipitate them; as it happens with respect to ammoniac. 9th. Reciprocal alteration by the various acids, decomposition or not; attraction of acids for metallic oxyds, change of the oxyds discoverable by their colour. 10th. Alteration by earthy or alkaline salts presenting either an union without decomposition, or a double decomposition. 11th. Reciprocal action of mineral salts showing either a simple union, or a simple change of bases by the acids, or a displacement of oxygen which precipitates the two oxyds, the one because it is partly *disoxyded*, the other because it is hyperoxyded; such is, for instance, the useful precipitation of the muriatic solution of gold by the muriatic solution of tin, which yields the purple precipitate of Cassius. 12th. Union of sulfurets and hydrosulfurets, earthy or alkaline; formation of species of sulphureous mines."

The appearance of this improved edition of the "Philosophy of Chemistry," as it has been very improperly called, in its English dress, induces us to wish that, like the French orator, the English orator of science, Mr. Davy, to whom this translation is dedicated, would devote some of his time to give an improved edition of his "Syllabus of Lectures" printed in 1802; we might then say that we have an elementary work on chemistry, worthy to rival the "Chemical Philosophy" of M. Fourcroy, and which might also be translated into eight living languages. The greatest defects, indeed, of the present work, next to its omission of the characters of the gases, and of endiometrical operations, are a multiplicity of divisions without distinctions, and distinctions without differences; a superabundance of terms frequently altogether unnecessary, and a general redundancy of words, occasioned by an attempt at excessive perspicuity,

which terminates either in confusion or inanity. The definitions in general are either redundant, defective, or otherwise inadequate to convey precise notions of the things defined. Many things are taken for granted as well established facts, on which no direct and decisive experiments have ever been made; and the observations and definitions of vegetable bodies are equally erroneous and defective. Notwithstanding these glaring defects, and many more on which it is unnecessary to dwell, the present volume presents such general views, if not of the philosophy of chemistry, at least of the modern system of explaining the chemical phænomena of nature, that every chemist will think it deserving his attentive perusal.

XXVIII. *Proceedings of Learned Societies.*

ROYAL SOCIETY.

On Thursday evening, Nov. 5, this Society assembled after the long vacation, the Right Honourable Sir Joseph Banks, Bart. president, in the chair. The whole of the evening was occupied in receiving, and in returning thanks for, the numerous presents of books from the Royal Academy of Sciences of Lisbon, and other foreign societies.

Nov. 12.—The president in the chair. A Bakerian Lecture on the Decomposition or Analysis of the Fixed Alkalis, by H. Davy, Esq. was read. The results of the experiments here modestly detailed in this perspicuous lecture are more important, except Galvanism, than any which have occurred since the discoveries of Priestley and Cavendish, and which have given the Transactions of the Royal Society of London a celebrity throughout the civilized world, unrivalled in the annals of philosophy. Mr. Davy, in his last Bakerian Lecture of last year, on the Agencies of Electricity, (see Phil. Mag. vol. xxviii. p. 1.) suggested the probability that other bodies, not then enumerated, might be decomposed by electricity. Since that time, by means of several very powerful Galvanic troughs, consisting of 100 pairs of plates of six inches square, and 150 pairs four inches

inches square, succeeded in decomposing potash and soda. This was effected by placing moistened potash or soda on a plate of platina, and exposing it to the Galvanic circle. Oxygen was disengaged, and these alkalis were reduced to their primitive base, a peculiar and highly inflammable matter, which assumes the form and appearance of small globules of mercury. These globules are lighter than any other fluid, as they swim in distilled naphtha. The base of potash is of a specific gravity as six to ten of water. At the freezing point these globules are hard and brittle, and when broken and examined with a microscope they present a number of facettes with the appearance of crystallization: at 40° of Fahrenheit they are soft, and can scarcely be discriminated from globules of quicksilver; at 60° they are fluid, and at 100° volatile. When exposed to the atmosphere they rapidly imbibe oxygen, and re-assume their alkaline character. In distilled naphtha they may be kept four or five days; but if exposed either to the atmosphere, or to oxygen gas, they almost instantly become incrustated with a coat of regenerated alkali: this incrustation can be removed, and the reduced globule will remain in naphtha, or separated from all contact with oxygen, as before; the naptha forming a thin film round the globule, and excluding the contact of oxygen.

Nov. 19.—The president in the chair. Continuation of Mr. Davy's Bakerian Lecture on the Decomposition of the Alkalis. One part of the base of alkali and two of mercury, estimated by bulk, (or about 1 part of the base to 48 of mercury by weight,) formed an amalgam, which, when applied in the circle of a Galvanic battery (which produced an intense heat) to iron, silver, gold, or platina, immediately dissolved these, and converted them into oxides, in which process alkali was regenerated. Glass, as well as all other metallic bodies, was also dissolved by the application of this substance: the base of the alkali seizing the oxygen of the manganese and of the minium, potash was regenerated. One of these globules placed on a piece of ice dissolved it, and burnt with a bright flame, giving out an intense heat. Potash was found in the product of the dissolved ice. Nearly

the same effects followed when a globule was thrown into water: in both cases a great quantity of hydrogen gas was rapidly liberated. When laid on a piece of moisteued turmeric paaper, the globule seemed instantly to acquire an intense heat; but so rapid was its movement in quest of the moisture, that no part of the paper was burnt, only an intense deep red stain marked the course it followed, and showed a re-production of alkali. The specific gravity of the base of soda is as seven to ten of water: it is fixed in a temperature of about 150°, and fluid at 180°. Mr. Davy next tried its effects on the phosphats, phosphurets, and the greater part of the salts of the first and second degree of oxydizement, all of which it decomposed, seizing their oxygen, and reassuming its alkaline qualities. The specific gravity of this amalgam, after a number of experiments, was found by means of a mixture of oil of sassafras with distilled naphtha, in which a globule remained either buoyant at top, or quiescent at bottom, in a fluid weighing as nine to ten of water.

The sixth section of this lecture detailed a great variety of experiments made to ascertain the difference of the base of *potash* from that of *soda*; and from the medium taken of numerous analytical, and of nine synthetical, experiments, it appeared that 100 parts of potash contain 15 oxygen, and 85 of inflammable base, and that the same quantity of soda contains 20 oxygen, and 80 base.

The seventh section was devoted to an examination of volatile alkali, which chemists, led by systematic theory, have rather hastily taken for granted that it consists merely of hydrogen and nitrogen. Mr. Davy, after a great number of complex experiments, in which he was assisted by Messrs. Pepys and Allen, ascertained that oxygen is also an essential ingredient in ammonia, 100 grains of the latter yielding 20 of the former: but this result depended too much on eudiometrical calculation to be received as an established fact.

The eighth and last section consisted of general observations on the "series of *new* facts" here disclosed, in which Mr. D. related some miscellaneous experiments on the muriatic

riatic and fluoric acids, all of which tended to prove that oxygen is one of their constituent principles. The earths of barytes and strontites, as being most analogous to the alkalis, were likewise examined, and both yielded considerable quantities of oxygen. Mr. D. concluded by remarking the impropriety of limiting the term oxygen to a specific character, as opposed to that of alkali, observed the necessity of improving the nomenclature in consequence of the new facts now discovered, and the influence of this "metallary base, as it might be called," on other bodies; and suggested the importance and extent of the new field these facts opened to geology, as likely to lead to numerous discoveries relative to the formation of various stones, strata, and mountains.

A paper by E. Home, Esq. on the Functions of the Spleen, was also partly read. Mr. Home, having had some reason to believe that the pylorus is not the only organ by which the nutriment, taken into the stomach, is appropriated by the system, but that the spleen also performs an important part in the process of animalizing the food, took a dog, fixed a ligature on the pylorus, and injected five ounces of a liquid, coloured with indigo, into the stomach: two ounces of this fluid were ejected, and, two hours after, the dog was killed; when only one ounce was found in his stomach, while two had been absorbed by the spleen, as the pylorus was found entirely empty. The liquid was decomposed, and the indigo deposited on the cardiac portion of the stomach.

SOCIETY OF ANTIQUARIES.

This Society assembled, as usual, on the 5th of November, which was occupied with receiving presents, and proposing or balloting for members. On the 12th, Sir H. C. Englefield, bart., vice-president, in the chair. Mr. Carter exhibited some exquisite drawings of Waltham Abbey, in the true Saxon style of architecture, built before the Conquest, and supposed about the year 1062. Several Roman coins, and copper basons, the latter most probably used for divination, were also exhibited. Mr. Weston presented to the

society a fac simile and translation of the inscription on the piece of ordnance in St. James's park, brought from Egypt. The inscription states the date of its foundry in 920 of the Hegira, (1542 of the Christian æra,) and also a description of its powers, as, "There is nothing can stand before me but I destroy and tear to pieces,—in my belly is fire, in my mouth thunder and death," &c. &c. These expressions, it must be confessed, are not less rational than Louis XIV's "*Lex ultima legum*," or Oliver Cromwell's "Open our mouths, O Lord, and we will show forth thy praise!" which decorated the cannons of these warriors at a much later period. On the 19th, Dr. Neil exhibited to the society the horn of a rhinoceros, found near Cairo. It was finely carved with several well-executed figures of animals, in bas-relief, about two feet long, and at the base nearly six inches in diameter. It is cut into the shape of a Turkey slipper, only with a spout like a mouth at the small end. A curious cup was likewise exhibited, on which were delineated the inebriety and excesses of Noah, Lot, his daughters, &c. It is of a cylindrical figure, made of walnut, holding about two quarts, lined with tin, and is conjectured to be very antient, and to have been the workmanship of our ancestors at a time when biblical characters were the chief subjects of art.

FRENCH NATIONAL INSTITUTE.

[Continued from p. 89]

Naturalists have therefore thought that animals endowed with instincts exercise these particular actions in virtue of an interior impulse, independently of experience, foresight, education, and external agents; or, in other terms, *that their organization by itself alone determines them* to act in this manner. This result has been adopted by almost all writers; and, if they have varied, it has been merely in explaining the manner in which organization can communicate this determination: the following is the hypothesis of one author upon this subject:

The want of, or the desire for, a certain action can only be

be occasioned by sensations or recollections of sensations; in a word, by images: but it is not necessary that a sensation should be an outward one; because every external sensation requires internal movements of the nerves and brain, without which it would not have taken place. Now these internal movements may arise in the organs themselves, without any external excitement; and thus it often happens in dreaming, and in different diseases: there is nothing, therefore, to prevent certain animals from being organized in such a manner that there are constantly in them interior movements proper for producing sensations, images, and so that these images determine imperatively their volition to certain actions.

This hypothesis seems to have nothing in common with that of innate ideas, which has for its object merely general or abstract ideas; because those who deny, with reason, that the general ideas of mankind are innate, have never asserted that man can have sensations in virtue of internal movements of his proper body, and without the intervention of external bodies; the experience of every day would have given the lie to their assertion.

Nor does this hypothesis seem to have any thing in common with that of materialism: for, whatever idea we form of the intimate nature of the thinking principle, we are always obliged to allow that it only experiences sensations by the intermedium of the brain and the nervous system.

In the last place, it has nothing which connects it more than another with the doctrine of fatalism; for, every action being determined either by an actual sensation or by the remembrance of a past sensation, or, lastly, by the fear or hope of a future sensation,—let these sensations be internal or external, the state of the question is not changed.

It seems to be, however, from the fear of falling into any of these labyrinths, that M. Dupont has indiscriminately rejected every kind of instinct whatever.

He begins by showing that the actions of animals of superior orders, such as quadrupeds and birds, result from the combination of their experience and their physical faculties: but he might have saved himself this trouble; all

naturalists

naturalists admit it. Afterwards he endeavours to explain physically how these animals, and children also, learn to suckle: he shows that several species have the power of emitting sounds numerous enough to form a very complicated language; and he asserts that he observed they employed some of these signs in circumstances so completely similar, that it cannot be doubted they attach a fixed signification to them. His observations on this head are very interesting, and must enrich the natural history of such species.

He also endeavours to prove that the species may perfect their processes in certain circumstances; but perhaps naturalists will here discover that he has sometimes mistaken different species for one and the same species in a state of greater perfection. Thus, the architect beaver of Canada is not entirely similar to the terrier castor of the Rhone; and the gregarious spider of Paraguay is by no means the same with our solitary spiders.

We may conceive, from what we have mentioned above, that the greatest difficulty for M. Dupont would be, to explain how insects have acquired the precautions, so marvellous, with which they prepare for the egg they produce, and for the worm it is about to hatch, the requisite security and nourishment; although these insects often never saw, or, if they did, never will see again, either a similar egg or a similar worm; and although the wants of the worm have no relation with those of the insect which works for it.

Among the multitude of examples which we may adduce, M. Dupont has chosen one only; but we do not think he has been happy in his choice; it is that of a *false solitary wasp*, the industry of which is as follows:—During its existence as a perfect insect it attaches itself to the flowers; when it is ready to lay its eggs it digs a cylindrical hole in clayey sand; it deposits an egg at the bottom: it then goes among some cabbages and seizes upon a small green caterpillar which it had never before made its prey; this caterpillar the wasp pricks with its sting, so as to weaken it, in order that it may not make any resistance against the worm which is about to issue from the egg and devour it: the caterpillar

terpillar is not injured by the wasp so much as to kill it, and thus make it liable to petrifaction: it then rolls it up into a circular form, and places it at the bottom of the hole: the wasp then proceeds to fetch eleven similar caterpillars successively, which it treats in the same manner: it then closes up the hole and dies. The small worm is now hatched; it devours the twelve caterpillars in succession, and then metamorphoses itself into a wasp, which leaves its subterraneous apartment and flies about among the flowers; it becomes impregnated by the male, and begins again, when it wishes to lay its eggs, precisely the same operations as its mother, and upon the same species of caterpillars.

M. Dupont de Nemours is not only obliged to suppose, and in fact he does suppose in his explanation, that the perfect insect preserves the remembrance of sensations experienced by it in the state of a worm, although it has entirely changed its form and its organs; but he must also think, although he does not say so expressly, that the wasp can never know by eye-sight the caterpillars and the sand, that it had never learnt to know them except by the touch, and even by its old touch as a worm; for when a worm it is blind, it lives in a dark cell, and when the wasp is hatched in this cell the caterpillars are no longer there. Lastly, as M. Dupont does not venture to admit that the wasp has the foresight that the egg it deposits will become a worm, and will require all the care it can bestow on it, he must intend to insinuate that the wasp does all this solely to amuse itself by imitating what it had seen in its infancy.

Such, in our opinion, are the difficulties which M. Dupont combats on the one hand, and such are the difficulties into which he plunges himself on the other hand. We have endeavoured to be impartial in our statement of them, but it does not belong to us to form any judgment as to their merits. Our readers who peruse M. Dupont's memoir will derive all the pleasure which the wit and imagination of this ingenious philosopher cannot fail to produce.

XXIX. *In-*

XXIX. *Intelligence and Miscellaneous Articles.*

THE COMET.

M. Bouvard, member of the French Institute and of the Board of Longitude, has published the following additional facts respecting this phænomenon:

"The comet discovered at Marseilles on the 20th of September is the most beautiful that has been seen these 30 years. Its nucleus appears like a star of the first or second magnitude, but its light is paler: its tail is not very extensive, being only a few degrees: its light, however, and that of its nucleus are striking enough to enable us to see it every evening.

"On the 30th of September I was informed of the appearance of this new comet, and on the same evening I determined its position with an excellent instrument. From this time I observed it regularly when the weather was favourable.

"The elements of its orbit have been determined by my observations; and by employing the method of M Laplace I found it had passed its perihelion on the 19th of September 1807, at 6h. 56m. in the morning, mean time, at Paris.

"Its perihelion distance, that of the Sun being taken at unity, is 0.6+7491.

"The longitude of the perihelion upon the orbit—27° 56′ 53″.

"The longitude of the ascending node 266° 39′ 40″.

"The inclination of the orbit 63° 14′ 1″.

"Heliocentric motion direct.

"This comet from the period of its discovery has been continually removing from the sun and the earth; its distance from the earth, however, surpasses that of the sun, and it increases every day. This comet will be still visible for some time; which will afford an opportunity for multiplying observations, and will be favourable to astronomers in supplying them with the means of ascertaining with great exactness the elements of its orbit, which resembles none of the orbits of any comet hitherto observed.

"Paris, 2d Nov. 1807."

A Me-

A Medical Gentleman has invented a new mode of secret writing, which can never be effaced but by destroying the paper; and which produces ten or twelve perfect copies as soon as one, with no more trouble to the writer. The same Gentleman, we understand, wrote the article "*Cipher*" for the new Cyclopædia, which has excited considerable attention in the literary world.

A New Edition of Mr. Parkes's Chemical Catechism, which has been for some time expected, has just made its appearance. We observe in it some very considerable additions and improvements. The "Essay on the Utility of Chemistry to the Arts and Manufactures," by the same author, and which makes a part of the above volume, may be had by itself.

VACCINATION.

M. Champagny, the French minister of the interior, has presented to the emperor Napoleon a report of the present state of vaccination in France. His majesty had directed M. Champagny to obtain authentic materials for this report, by inviting the prefects and clergy of all the departments in the empire to transmit to Paris official documents on the subject. M. Champagny has displayed great zeal for the interests of humanity in the performance of the task thus imposed upon him; and in the masterly report he has presented to the emperor on the subject, he records the names of such of the French clergy as have been most active in the propagation of the vaccine among their parishioners. The emperor, on perusing the report, ordered M. Champagny to intimate to these enlightened ministers of the Christian religion, that their names should be remembered in the future distribution of church preferments.

M. Champagny, in his report, expresses his regret that the vaccine should have met with some opposition from the ignorant in France, in consequence of the translation of some pamphlets from the English language, and suggests that his majesty should issue some restriction upon the circulation of works of a tendency hostile to vaccination.

While

While the above encouragement has been given in France to the vaccine inoculation, the king of Bavaria has gone a step further in the cause of humanity. By a royal ordonnance lately published, his majesty has decreed that every child within his dominions who has not attained the age of three years shall be vaccinated before the 1st of July 1808, and that every infant born in future within his dominions shall undergo the same inoculation within three months after its birth. Heavy penalties are inflicted on the neglect of this decree, and inoculation for the small-pox is prohibited under pain of imprisonment.

M. Lechenault, one of the naturalists who accompanied the French circumnavigator captain Baudin, has arrived at Paris. He has brought with him a fine collection in natural history, consisting of minerals, mammiferous and oviparous quadrupeds, serpents, birds, shells, and insects, with a magnificent *hortus siccus*, and a very rare collection of arms and instruments from India, Otaheite, Java, and other neighbouring islands. M. Lechenault left captain Baudin at Batavia in extreme ill health.

LIST OF PATENTS FOR NEW INVENTIONS.

To William Pedder, of Norfolk-Street, Strand, London, Esq for an improvement to cattle-mills, and water-mills for grinding sugar-canes, or any other mill or machine requiring additional velocity and power. October 19.

To Tebaldo Monzani, of Old Bond-Street and Cheapside, London, music-seller, for a new German flute. Oct. 19.

To Edward Shorter, of the parish of St. Giles Cripplegate, in the city of London, mechanic, for certain improvements in the jack for roasting meat. October 19.

To Louis Caron, of the city of Paris, but now residing in the city of London, manufacturer, for new methods of weaving or manufacturing hair along with silk or thread, or other materials, and of making the same into perukes or wigs, and various other articles, so as to imitate nature; and of taking the measure, or section, or profile, of the head,

by

by an instrument applicable to that and other useful purposes. October 21.

To Henry Thomson, of Tottenham in the county of Middlesex, merchant, for impregnating Cheltenham or other natural medicinal waters, or such as are usually denominated "mineral waters," with one or more of the different gases or aëriform fluids, and in adding other substances to, or combining the same with, such waters. October 30.

To William Chapman, of the town and county of Newcastle upon Tyne, civil engineer, and Edward Walton Chapman, of the same place, rope-maker, for their method or methods of making a belt or flat band, for the purpose of drawing coals and other minerals up the pits or shafts of mines; and for raising of heavy articles in any situation whatever. October 30.

To George Hawks, of Gateshead in the county of Durham, iron manufacturer, for a new method of making, and likewise of keeping in repair, cast-iron wheels for coal waggons, and other carriages where such wheels are applicable. November 6.

To John Dickinson, of the parish of St. Martin Ludgate, in the city of London, stationer, for cannon cartridge paper manufactured on an improved principle. November 12.

To Joseph Jewell, of Stratford in the county of Essex, chemist, for his method of preparing, or reducing to an impalpable powder for medicinal use, the substance commonly called or known by the name of calomel; whereby the process usually employed of levigating the same is rendered unnecessary. November 17.

To William Lester, of Paddington Green in the parish of Paddington, in the county of Middlesex, engineer, for various further improvements on an engine or machine for separating corn seeds and pulse from the straw and chaff; and for which said engine or machine the said William Lester obtained his majesty's letters patent dated the 16th of January, 1805. November 21.

METEORO-

METEOROLOGICAL TABLE,
BY MR. CAREY, OF THE STRAND,
For November 1807.

Days of the Month.	Thermometer. 8 o'Clock, Morning.	Thermometer. Noon.	Thermometer. 11 o'Clock, Night.	Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
Oct. 27	46°	50°	40°	29·50	0	Rain
28	37	42	40	·78	7	Fair
29	40	52	46	·52	6	Cloudy
30	39	50	46	·48	0	Cloudy
31	45	50	46	·85	7	Fair
Nov. 1	46	52	47	·62	15	Fair
2	46	51	50	·68	18	Fair
3	42	47	37	·23	25	Fair, stormy at night
4	40	46	35	·45	17	Fair
5	35	50	47	·45	10	Cloudy
6	40	49	46	·51	27	Fair
7	45	51	44	·32	18	Fair
8	44	45	40	·22	12	Fair
9	35	43	41	·45	24	Fair
10	35	48	38	·22	20	Fair
11	37	42	32	·38	8	Fair
12	31	38	32	·85	6	Fair
13	32	38	35	·96	10	Cloudy
14	35	42	37	30·03	4	Cloudy
15	42	44	42	29·98	7	Cloudy
16	44	45	41	·89	10	Cloudy
17	40	43	39	·84	7	Cloudy
18	39	40	32	·56	10	Cloudy
19	33	37	41	·16	0	Snow
20	40	41	32	28·72	12	Stormy
21	31	36	31	29·39	14	Fair
22	30	39	47	·36	0	Rain
23	44	46	36	·02	0	Stormy
24	31	33	34	·25	11	Fair
25	35	41	35	·42	10	Fair
26	34	41	30	·44	9	Fair

N. B. The Barometer's height is taken at one o'clock.

XXX. *Proposal for the Establishment of a National Museum. By* J. S. Duncan, *Esq. of Lincoln's Inn.*

To the Artist, the Man of Taste, the discerning Politician, the sincere Patriot, the Man of pure Morals, and of rational Religion, this Design for a Museum, calculated to unite Instruction with Amusement, is, with respect, dedicated by

J. S. Duncan.

NATIONAL MUSEUM of NATURAL HISTORY.

It is proposed to establish a grand National Museum to exhibit in scientific arrangement the principal objects of natural history. By a national museum is meant, not merely a collection of rarities, however wonderful, of novelties which may surprise, or of anomalies which may confound the learned; but a methodical display of that instructive order and harmony which the wise Author of all being has been pleased to manifest through all his works: an exhibition of the

> "..... bearings and the ties,
> The strong connections, nice dependencies,
> Gradations just—"

which cannot fail to excite even in rude minds emotions of delight, and which tend to impress those improved by the most moderate culture with salutary awe, and a conviction of the all-disposing, all-prevailing wisdom, power, and glory of the omnipresent Deity.

The writings of Ray and Derham, and the excellently methodized Natural Theology of Paley, will be proper introductions or companions to the National Museum. It is obvious that the lecturer, preacher, and writer, have to contend with many impediments of language, while by that medium alone they endeavour to sway the heart and to affect the understanding. Eloquence however animating, propositions however clearly enounced and syllogistically proved, do not associate with the impressions of surrounding objects so constantly and forcibly as events actually witnessed, and effects with their proximate causes exhibited to the senses. The superiority of example to precept is a pro-

verb of all schools: this truth is explained in the most simple manner by the observation of the mental process, which associates impressions with ideas, the present with the past, giving activity to memory, and strength to habit. A museum comprehending all objects of natural science, exhibiting in regular arrangement their classes, orders, genera, species, and varieties, while it shall preach and lecture to the eye and to the touch, will illustrate the discourse of the philosopher and the divine, and store the mind with images which will readily associate with the objects of daily and of hourly occurrence.

Perhaps no religious truth has equal force to subdue the fluctuations of the human soul, to repress in the instant of temptation the beginnings of sinful emotion, with that which impresses on the mind and heart the universal actual presence of the all-beholding Deity. It is not a light undertaking, a project of temporary amusement, which proposes to associate every object of nature with this awful idea, to cause its continual recurrence, and induce it to predominate with the energy of habit.

That the scheme of forming a museum with a moral and religious view is rather novel, may perhaps be admitted. The curiosity of naturalists has probably impelled them, for the most part, to collect, and some vanity may have mingled with the philanthropy which has displayed to the public their miscellaneous rarities. These principles and these collections have however been subservient to the views of general science; they have enlarged its scope and extended its career: but science itself is destitute of dignity, unless it be derived from its unwearied service, its high fealty to morals and religion. These can alone invest with proper dignity, and sanction with the broad stamp of utility, the charter of a national museum.

Yet to encourage public amusements in their nature wholly innocent is not unworthy of wise legislators. How few public diversions are entitled even to this praise. To diffuse joy amongst the subjects of its care is a glorious effort of an enlightened government: but to mix instruction with delight—*delectando pariterque monendo*—to range the passion

for

for amusement on the side of virtue, is entitled to the higher praise of generous and far-sighted policy.

The games of ancient Greece and Rome were grand political institutions. They were employed to call forth into action a display of various talent, to excite ardent emulation, to sooth the public mind, and divert it from the irritation of calamity, or of ignorance inflamed by faction: but they also were tributary to the elegant arts, and gave some of their richest stores to painting, poetry, and sculpture. What can more surely tend to the refinement of taste, as applied to the graces of art, than the habitual contemplation of the brilliant varieties, the elegant gradations and harmonies of form and colour displayed throughout every department of inanimate as well as of animated nature?

The advantages of such an establishment to the purposes of scientific inquiry are too obvious to need specification.

A national museum, considered in these points of view, as adapted both to the instruction and delight of the nation at large, cannot fail, it is presumed, to interest all classes in its favour.

We are blest with a sovereign under whose auspices and protection every liberal science, and the arts in all their branches, have arrived at a degree of perfection exceeding, in most respects, the attainments of all other nations. The globe has been widely and accurately explored, and our connections with distant regions extended beyond all comparison with those of any other people in any period of time.

It is believed that a scheme of establishing a national museum has already been contemplated by his majesty, together with some leading members of his late administration; and that the museum collected by Sir Ashton Lever would have been purchased as the foundation of such an establishment, had the specimens been found in a due state of preservation. It may not be improper here to observe, that a museum formed on a preconcerted plan of scientific arrangement, is not likely to be attended with the expenses in which a rage for rarities frequently involves the emulous collector.

Our catalogue of scientific men, whose names do honour to their age and country, is too long to be here inserted. It

may suffice to name Sir Joseph Banks, the patron of natural science, and the student's friend; Dr. Shaw, the classical historian of animated nature; Dr. Smith, alter Linnæus;—Mineralogy and chemistry boast of their Chenevix, Hatchett, Davy, and Thompson;—Geology of De Luc, of Sir James Hall, Lord William Seymour, and of Kirwan;—Comparative anatomy of Home, Carlisle, Cowper, &c. &c.

The wealth of our merchants is equalled by the enlightened views which direct their magnificent liberality. Their ardour for the advancement of the liberal arts is displayed in their establishment of the City Institution, and in the Oriental College at Hertford. It is not to be doubted that they will extensively support the proposed museum by a gratuitous importation of the productions of distant regions, which may be pointed out to them as requisite to the advancement of such an institution; and at the same time freely contribute to a fund for its permanent support.

The spirit of general inquiry awakened by the Royal Institution, will secure powerful and numerous friends to the establishment at the court end of the town.

Contributions of specimens from private collectors, whose names should be inscribed and exhibited with honour, will soon make the difficulty of selection much exceed that of collection.

It is hoped that his majesty's ministers may be induced to allot a sufficient sum for the purchase of a spacious house in an airy part of the town, to chartered trustees, empowered to receive subscriptions to a limited amount, upon a plan of tontine, in which the trustees may be survivors.

It is proposed that a sum of be raised by subscription, or sale of shares, at the rate of for each share; and that the holders of such shares be entitled to receive interest thereon, not exceeding the rate of five per cent., whensoever such division can be made from actual receipts, and to increase such interest by annual addition, in proportion to the deaths of the several holders of shares, till the original nominees be all dead; when all profits arising from the institution shall cease, or be applicable wholly to the purposes of the institution.

In

In order to raise money for the payment of such interest on the subscribed capital, it will be requisite that a certain sum be collected at the door from each person demanding admittance to view the museum.

It is proposed that such sum should not exceed two shillings for each person.

That on one day in every week the museum be open to any of his majesty's subjects not paying for their admittance. Not more than fifteen to be admitted at one time, and a certain portion of time to be fixed for showing the museum on such days to each party.

That the trustees and officers of the museum, and members of a committee, to be appointed for conducting the affairs of the museum, be allowed to grant tickets for the gratuitous admission of well-educated foreigners.

That a part of the sum collected for the establishment of the National Museum be vested in the names of the trustees in the government funds, and that the dividends thereon be applicable to the payment of certain officers and servants required for the arrangement and exhibition of the museum.

Other œconomical details may be considered at the first meeting of subscribers, when a committee must be appointed.

Not to encumber this proposal with the enumeration of the several classes, &c. of natural objects, it may suffice to observe, that it is fundamentally essential to the great objects above expressed, that every article be disposed according to the most approved method of scientific arrangement.

With a view of illustrating the important arguments so luminously developed in Dr. Paley's Natural Theology, it is proposed that a considerable part of the exhibition be dedicated to comparative anatomy, illustrated by natural specimens or models, either separately assembled, or displayed in rooms dedicated to the several branches of zoology*.

Adjoining to each press, containing specimens of every

* But a small part of the British Museum is dedicated to objects of natural history. The specimens of zoology are without arrangement, and greatly decayed. There is no fund for replacing those which moulder away, nor for augmenting the collection.

department, should be suspended moveable tablets, enumerating the several objects, particularising the connecting points of different classes, and specifying remarkable analogies and anomalies.

Such tablets will at once assist the apprehension of the spectator, and facilitate the exhibition.

ΤΩ ΘΕΩ,

Παντεργατη, Παντοπτη, Παντοκρατορι.

What worthier temple can we raise to his glory than one which, presenting to the senses an epitome of his works, may serve as a pronaon to the temple of his creation, of which the heavens are spread out as the vault*, the height of the sanctuary†, wherein, sitting on the circle‡ of the earth, he calleth all things by their names, and bringeth out their hosts by number, and maintaineth them by the greatness of his might.

ARGUMENT

Introductory to the Collection of Tablets, or Catalogue of the National Museum.

"It is impossible to know any thing of the cause but what you have antecedently, not inferred, but discovered, to the full, in the effect." HUME.

All nature presents us with a series of important hieroglyphics, a part of which is easy of explanation, a part appears to lie beyond the reach of human faculties.

The explicable part involves truths which concern us above all others: namely, our relations to all other beings, and to the Author of all modes of being, of all order, physical and moral.

The relations of the different parts of the forms of living beings to the continued subsistence of individuals subject to thought and voluntary power; the relations of individuals to each other, and to the continuance of species, subjected to the exertions of thought and voluntary power; and the

* "Vault." Esdras, xvi. 59.

† "Sanctuary." Psal. cii. 19.

‡ "Circle." Isaiah xl. 22 and 26.

relations

relations of all objects of sense and reflection to the well-being of animated individuals, and species subject also to thought and voluntary power—are effects in which we fully discover a power controlling other powers : such as attraction, repulsion, or impulse, capable of comprehending all such relations; to which power all animated beings are consequently related, as effects to a supreme cause.

1. We perceive changes in the objects of our senses and of our consciousness ; motion beginning and ending ; forms now distinct, now united ; now dissolved, now restored.

2. When we move our own limbs, or give motion to, or restrain the motion of, another body, we are conscious of exertion preceding the motion.

The degree of exertion required to move or to restrain the motion of any power, is called power.

3. This exertion is commonly preceded by thought and will : of which also we are conscious.

Change implies motion of the sense, or of the object : hence all perceived or supposed causes of change are included under the common or general name—power.

4. When objects are perceived to move one towards another with velocity, continually increasing as they approach, we say they are moved by powers of mutual attraction.

5. When bodies so moved become fixed in contact, we say they cohere by powers of mutual attraction.

6. Cohesion is broken or dissolved by new, superior, and opposite attractions, or by communicated motion from bodies moved by power, greater than that which held the cohering bodies together.

Experience shows that the continuance of an effect may be preserved by a less degree of power than that which was required to produce it.

The communication of motion, whether by the exertion of living beings, or from any moving body to another body, either moving at the same time or at rest, is called impulse.

7. When bodies are perceived to recede from one another in right lines, with velocities decreasing in proportion to

their distance, we say they are moved by mutual powers of repulsion.

8. Our experience of mutual attractions, of mutual repulsions, or of impulse proceeding from both or from either, does not discover any tendency or power, in all or either, to produce or restore forms possessing distinct parts, in which each part concurs to the continued subsistence of the other, and of the whole.

9. Forms known to have been constituted by the cohesion of others, before known to have been distinct, and forms known to have been dissolved, and to have been again restored, are never perceived to have mutual relations to the permanent subsistence of each other.

10. When the forms of animated beings are dissolved, the particles are observed not to attract one another generally: but several kinds of particles are distinguished by their different attractions: they unite and compose different forms, each bearing no relation to the permanent subsistence of any other.

11. The forms therefore of animated beings, and consequently the relations observed in the distinct parts, do not appear to proceed from attraction, repulsion, or from impulse derived from these.

12. The particles of inanimate forms, united by mutual attraction, remain in the same circumstances unchanged for ages; but those of animated forms are subject to continual change, and in a short time fall asunder. This tendency to separate and dissolve soon follows the cessation or abstraction of life, thought, and voluntary power.

13. When we consider the powers which conduce to any mode of being, as attraction, &c., experience leads us to conclude that the power which causes the continuance of an effect was the same, or is analogous to that which produced the effect.

14. But different parts of the forms of animated beings bear relation to the continued subsistence of each other, of individuals and of species, subject to the exertions of thought and voluntary power.

15. Dif-

15. Different animated beings bear also relation to the continued subsistence of each other, and of their respective species, subject to the exertions of thought and voluntary power:—mothers to their offspring; males and females to their species.

16. Relations of position perceived in things whose continued mode of being is the effect of mutual tendencies, influencies, attractions, or impulses of particles, to concur and cohere, are artributable to the same tendencies which have produced the concurrence and cohesion. Relations between forms having no such tendency to cohere, independent of life, (v. clauses 8, 9, 10,) and dependent for continued subsistence on the exertions of thought, and voluntary power, are, by analogy, attributable to life, thought, and voluntary power.

17. Either life, thought, and voluntary power, exist independent of form, or they are produced by form; or the concurrence of particles, not independently possessing either, or the cohesion of particles having no mutual tendencies to concur, cohere, and subsist, in such manner independent of them. The latter supposition makes life, thought, &c., both cause and effect; which is absurd.

Our experience is direct, that life, thought, and voluntary power are neither jointly or separately the results of form: their continuance is not affected by the amputation of great part of the form of animated beings.

18. The duration of the form of animated beings is limited by laws peculiar to each species of living beings: its relations to life, &c., are therefore limited.

The limited duration of the forms of living beings is ordained by the power which constituted the varieties of form.

19. The limitation of a mode of being is a prospective ordinance; it is the act therefore of a power, regarding a future state of being different from that immediately produced.

20. The power which has constituted the forms of living beings comprehends all relations to life, thought, and voluntary power, limits and controls attraction, repulsion, and impulse;

impulse; limits and controls the duration of its productions. The power comprehending, constituting, limiting, precedes and exceeds the constitution, the effect, the production.

A power then is manifested through all animated nature, anterior and superior to all limited modes of being; the source of all order, or relations to life, thought, and voluntary power.

21. But beside the relations of the parts of animated beings to each other, and of individuals of the same species to each other, which conduce to the continued subsistence of the individual, and of the species, subject to the exertions of thought and voluntary power, relations are perceived throughout all nature to the well-being, the utility, welfare, and happiness of living creatures.

22. We know from consciousness, and from analogy, that the exertions of thought and voluntary power are continually directed to utility and happiness as their ultimate objects.

These exertions, which draw bodies without attraction, sever them without repulsion, impel by communicating, not pre-excited, but original self-motion, dispose and adapt various parts of nature to their ends—utility and happiness. The ends of their exertions are therefore, in some degree, similar to those of the power which has constituted the relations of animated form, and subjected it to their direction.

23. As we trace mutual attractions from minute particles of solids and fluids to the wide extent of the ocean and the atmosphere, to mountains and to worlds; so relations to the utility and happiness of living beings may be traced from objects of the microscope to the profundities of space; from the farina on the anthers of the wheat-blossom, to the revolutions of our planet round the sun.

24. But all natural relations to the well-being of individuals and species are interwoven, and inseparably mingled with those which concur to their continued subsistence. All natural relations, then, to the welfare and happiness of animated beings proceed from the same source, with all other relations to life, thought, and voluntary power.

25. The relation of an organizing power to the continu-

ance

ance of any mode of being may be as that of an artist to a machine: but the relation of an adequate power to the welfare and happiness of intellectual beings is a moral relation; a relation either identical with, or analogous to, sympathy, or benevolence, or care to produce present good, or a prudential view to future benefits. Such relation must proceed from superior to inferior power and intelligence.

26. Experience and consciousness, then, demonstrate our relations to a power stupendous and immeasurable; the author of all relations to life, thought, and voluntary power: a power that regards our happiness; that has contemplated prospectively our welfare in futurity; the welfare of the man ere the fœtus was perfect in the womb; that has limited the relations of our form to life, and thought, and voluntary power, and placed there the limits of physical experience.

The state of life, and thought, and voluntary power, beyond these limits must be sought in the page of Revelation, which can alone elucidate those hieroglyphics in the book of nature, which conjecture, aided by analogy, may partially explore, but which appear, for the most part, to lie beyond the reach of our unassisted faculties.

27. We never fail to connect the idea of moral duty with that of the moral relation of inferior to superior intelligence. The wants of our nature compel us to be social beings; i. e. place us in various moral relations one to another. The power that has thus placed us, has, by this act, ordained every moral duty, imposed every moral obligation. The welfare of all human beings is made to depend on the general observance of these obligations, the performance of these duties.

28. We know from experience and consciousness that our relations to all objects around us are adapted to the continual excitement of moral emotion. All nature teems with objects of delight; we are organized to receive it, &c. These relations are as plain as those of lungs to air, and limbs to motion. We are made to depend on others for our happiness: we demand their efforts to effect it, and feel their claim on us for similar exertion. Sympathy urges us to act before reason can adjust the measurement of right.

We

We owe our being and our well-being to a superior power, which has ordained that our happiness shall principally depend upon our own exertions. Wisdom to discern and choose between good and evil, is, perhaps, sufficiently attainable by all; and gratitude for the various good presented to our reach, affords a constant bias to that course of action which best suits the state in which we find ourselves placed by the all-disposing Power.

29. But, Why are we compelled to choose between good and evil?

Why is evil permitted to exist?

Why are we limited in faculties?

Why in duration of form?

Why are we in any respect as we are?

No objects of sense or consciousness, from which alone we derive knowledge, furnish us with answers to these questions. We must again seek light from revelation.

30. Let us contemplate with attention the relations of our forms to life, thought, and voluntary power, and to the limited continuance of our mode of being; the relations of individuals to each other, and to the continuance of the species; the relations of different parts of nature to animated beings; the food adapted to peculiar organs; the organs to peculiar food; peculiar forms to various elements, or different regions of the earth; the tendency of various objects to excite our emotions; the tendency of our natures to be so affected; the display of wisdom and wonderful contrivance in the varieties of creation; of power in the magnitude of worlds, and the extent of their relations:—let us train our thought to meditate on our relation to the mighty Author of these boundless wonders. Can minds thus habitually exercised be disunited? Can moral duties be neglected by those who reflect on the Author of all moral relations? Would not all party-differences be absorbed, all base propensities be overwhelmed by the magnitude of the one glorious object of our contemplation? Would not wisdom result from the constant contemplation of the fountain of all wisdom? Would not benevolence flow throughout all beings from the contemplation of benevolence wide as the universe,

universe, and enduring to the end of time? Would not, must not, the result be universal happiness?

To promote such contemplation, and such results from it, is the chief object of the National Museum.

[To be continued.]

XXXI. *Project for the Establishment of Telegraphs on a New Construction. By* Capt. Pasley, *of the Royal Engineers*.*

1*st. A Nocturnal Telegraph.*

Having found, on inquiry made about four years ago into the progress of the telegraphic art, that no regular establishment of night-signals have yet been instituted, similar to that of the diurnal telegraphs in common use, so that all correspondence of this nature is suspended during a period when it may often be essentially necessary, I was induced to form the following project for a Nocturnal Telegraph, which, together with the second plan that afterwards occurred to me, my remaining upon foreign service has hitherto prevented me from submitting to the attention of the public.

Nature and Construction.

The proposed telegraph consists of six fixed lights, disposed in two rows of three lights each, one row placed exactly over the other†.

* Communicated by the author.

† There have been several nocturnal telegraphs already proposed, some with more, some with fewer lights, some with one or more coloured lights; any discussion upon which, or comparison of those schemes with my own, would be improper, unless I were writing an essay on telegraphs: but it is right for me to acknowledge that there is one in the Naval Chronicle, proposed by Mr. M'Arthur, consisting of the same number of lights as mine, to which gentleman I must therefore resign the merit of first proposing a night telegraph with six lights; but as the disposition of his lights, the object of his telegraph, (which is meant for ships,) its principle, its key, and, in short, every thing else are quite different, there appeared to me, after I saw his plan, sufficient originality in my own, not to withhold it from publication on account of this particular coincidence. If partial similarity were in all cases an objection, there would be an end to improvement in the arts.

These are supposed to be kept constantly burning whilst the telegraph is worked; and being hid or shown at pleasure by means of blinds, they form forty-one distinct combinations or signals; the combinations of six bodies, which should properly be sixty-three, being reduced to this number by the ambiguity arising from its being impossible to ascertain the relative places of objects by night as by day.

The construction of the telegraph will be understood by conceiving six large lanthorns attached to a strong frame of timber, placed in the upper room, or on the roof or terrace of a building; in which latter case it may be protected by a shed from the injuries of the weather. Each of these lanthorns will contain a lamp, the intenseness of whose light must be proportioned to the distance between the telegraphic stations, upon which the distance of the several lanthorns on the frame from each other will also depend.

Every lanthorn must have two blinds, one on each side of it; to which will be fastened strings passing through the ceiling of the signal-room, and guided by pulleys to a convenient place below, where they can be worked by a single man. The blinds are so hung, that in their natural state, when the telegraph is at rest, all the lights are hid except the middle one of the lower row, which serves to guide the eye of the observers, and is therefore called the standing light, being always exhibited during the intervals between successive signals.

The Key.

In the table of combinations, or key of the telegraph annexed, it will be observed, that after leaving one for the standing light, and assigning thirty combinations to denote the letters of the alphabet, numerical cyphers, &c., the remaining ten places are left blank. It is needless to explain the use of the first thirty signals, which are capable of communicating every kind of intelligence alphabetically, in a manner which must be evident on inspection*. I have only therefore to point out

* The list of numbers appropriated to the several signals is not to be considered a part of the key, although I have found it convenient to insert them there. They are of use only in the mechanical operation of working the telegraph, when every string being numbered, they serve to show which of them must be pulled, in order to make the respective signals.

how the blanks may be filled to the best advantage, and how, by means of these, an extensive code of signals may be formed to suit the proposed telegraph, and considerably to abbreviate its operations. But I shall not pretend to give an example of such a code at large, for its contents must necessarily vary according to the circumstances of the country where such establishments may be made, and the arrangement of it must be left to the judgment of the persons who direct them.

Different Modes of forming a Code of Signals.

Let any number of words and sentences that are most likely to occur in practice, be written in regular order to the extent judged necessary, and if these do not exceed 300, let them be divided into sections according to a method explained in the following table.

Number of sections made use of.	Number of places in each section.	Total number of words and sentences forming the code of signals.
1	 39	 39
2	 38	 76
3	 37	 111
4	 36	 144
5	 35	 175
6	 34	 204
7	 33	 231
8	 32	 256
9	 31	 279
10	 30	 300

Then let one of the blanks denote that "*The ensuing signal will be read in the first section;*"—Let a second blank denote that "*The ensuing signal will be read in the second signal,*" and so on; and thus may any list of words and sentences, under three hundred, be represented by two changes on the telegraph, exclusive of all unusual or unexpected intelligence, which may be communicated alphabetically by the ordinary key.

But when the number of words and sentences required exceeds 300, the signal-book must be divided into two parts, the

the first of which will contain a certain number of sections, composed of thirty places each, whilst the second will contain a number of sections, consisting of nine hundred places each, observing only, that the number of sections in both parts added together must not exceed ten: then, instead of filling up the blanks in the manner before proposed, a certain number of them must denote, that "*The ensuing signal must be read in such a section of part first,*" whilst the remaining blanks will signify, that "*The two ensuing signals must be read in such a section of part second,*" specifying the particular sections of each; and according to the manner in which the two parts are divided, will be had a code of signals more or less extensive, as is shown in the following table, by which it will appear, that if the method used in the second part is carried to its utmost extent, by filling up all the blanks in that manner, a signal-book may be formed containing 9000 words and sentences, that may be represented by three changes on the telegraph, retaining still the power of using the alphabetical mode when necessary, as before: and that number is more than can ever be either useful or necessary in practice, but it might be increased on the same principle to an almost unlimited extent.

Number of sections in part 1st.	Number of places in each.	Number of words and sentences in the first part, represented by two changes on the telegraph.	Number of sections in part 2d.	Number of places in each.	Number of words and sentences in the second part, represented by three changes on the telegraph.	Total No. of words and sentences that may be written in the signal-book.
9	30	270	1	900	900	1170
8	30	240	2	do.	1800	2040
7	do.	210	3	do.	2700	2910
6	do.	180	4	do.	3600	3780
5	do.	150	5	do.	4500	4650
4	do.	120	6	do.	5400	5520
3		90	7	do.	6300	6390
2	do.	60	8	do.	7200	7260
1	—	30	9	do.	8100	8130
0		—	10	do.	9000	9000

For

For supposing that only nine of the blanks are used to refer to sections of words and sentences arranged according to the foregoing method, then the tenth blank may denote that "*The three ensuing signals are to be read in a third part,*" which may be added to the signal-book, and may contain 27000 places of words and sentences, each of which will be represented by four changes on the telegraph.

So that supposing we have six sections in part the first, three sections in part the second, and one only in part the third, we might form, if necessary, a code of signals consisting of

PART 1st.

6 × 30 = 180 words and sentences that may be expressed by two changes on the telegraph.

PART 2d.

3 × 900 = 2700 words and sentences that may be expressed by three changes on the telegraph.

PART 3d.

1 × 27000 = 27000 words and sentences to be expressed

Total 29880 by four changes on the telegraph.

The manner of arranging the signals in this system by sections is, strictly speaking, numerical; but as we carry our combinations as far as 30, not stopping, as usually practised, at the number 10, it may in some respects be more aptly compared to the disposition of words in a dictionary.

In the first part, the places in each column are regularly numbered from 1 to 30.

In the second part, (containing what may be called the double signals,) the first place of each section is numbered 1, 1, the second 1, 2, the third 1, 3, and so on up to 1, 30: after which begins, 2, 1, 2, 2, 2, 3, &c., &c., up to 30, 30; which is the 900th, and last place of the section.

In the third part, if necessary, containing the triple signals, the first place is numbered 1, 1, 1, the second place 1, 1, 2, &c., &c., up to 1, 1, 30; after which commences 1, 2, 1, 1, 2, 2, 1, 2, 3, &c.; and if this were carried to its utmost extent, the last place, numbered 30, 30, 30, would be the 27000th in regular order.

KEY OF THE TELEGRAPH.

Numbers appropriated to the several signals.	Combination of LIGHTS forming.	Signal No.	SIGNIFICATION.	Numbers appropriated to the several signals.	Combination of LIGHTS forming.	Signal No.	SIGNIFICATION.
1	o o	1	A		o o o o	21	3
2	o o	2	B		o o o o o	22	4
3	o o	3	C hard, K, Q		o o o o o	23	5
4	o o	4	D		o o o o o	24	6
1,2	o o o	5	E		o o o o o	25	7
1,3	o o o	6	F		o o o o o	26	8
1,4	o o o	7	G		o o o	27	9
1,5	o o o	8	H		o o o	28	10 initial O
2,3	o o o	9	I, J, Y		o o o	29	End of a word or number.
2,4	o o o	10	L		o o o o o o	30	Attention, Finish.
2,5	o o o	11	M		o o o	31	
3,4	o o o	12	N		o o o	32	
1,2,3	o o o o	13	O		o o o	33	
1,2,4	o o o o	14	P		o o o	34	
1,2,5	o o o o	15	R		o o o o	35	
1,3,4	o o o o	16	S, Z, C soft		o o o o	36	
1,3,5	o o o o	17	T		o o o o	37	
1,4,5	o o o o	18	U, V, W		o o o o	38	
2,3,4	o o o o	19	1		o o o o	39	
2,3,5	o o o o	20	2		o o o o o	40	

N. B. Blinding the standing light during the interval between two signals will denote that the signal last made has *Standing* o *Light.* been mistaken by the men at the answering station, and will be repeated for their better observation.

[To be continued.]

XXXII. *Some Observations on Dr.* TAYLOR's *Theorem for the Development of the Function* $\varphi(a + x)$.*

WHEN the *Methodus Incrementorum, &c.* was first published, some of the continental analysts seemed to think that the theorem $\varphi(a + x) = \varphi(a) + \frac{x}{1} \cdot \frac{d\varphi(a)}{da} + \frac{x^2}{1 \cdot 2} \frac{d^2\varphi(a)}{da^2} +$, &c. which doctor Taylor had given as a discovery of his own, was really the same with another theorem which John Bernoulli had previously investigated, and by which he had been led to the value of $\int y\,dx$, when y is a function of x alone. Bernoulli, however, was himself too well informed to support this opinion openly; but under his patronage the question was agitated; and he tacitly, at least, permitted the republication of the papers against Taylor in the collection of his works, which was edited at Lausanne in 1745. But, whatever may have been the opinion of Bernoulli and his supporters, the after-judgment of succeeding analysts has settled the debate; and it is now universally admitted that the two theorems are totally different in the objects and purposes to which they can be applied. That which was discovered by Taylor has, under the hands of La Grange, been made the basis of a calculus similar in its uses and extent to the differential calculus; and the other, which was given by Bernoulli, performs the same office in the integral calculus to which the former is adapted in the differential.

Betwixt the two theorems, however, there is not that difference which might be expected to arise from the diversity of their objects of application, and the opposite principle upon which their demonstrations have been made to rest. The one may be very easily deduced from the other: but, although this is the case, there is not the least reason for confounding the theorems together; nor does this circumstance afford even the shadow of a reason for alleging any similarity between them. The process on which we are

* Communicated by the Author.

about to enter will explain a method by which the one theorem may be deduced from the other; and at the same time it will illustrate the analytical distinction betwixt them.

By the theorem of Taylor we have $\varphi(a+x) = \varphi(a) + \frac{d\varphi(a)}{da}x + \frac{d^2\varphi(a)}{da^2}\cdot\frac{x^2}{1\cdot 2} +$, &c.; and, if we take the successive differentials of this equation according to a, we shall obtain a series of new equations, by means of which we can easily eliminate all the terms on the right hand side except the first, and the result will be $\varphi(a) = \varphi(a+x) - \frac{x}{1}\cdot\frac{d\varphi(a+x)}{dx} + \frac{x^2}{1\cdot 2}\cdot\frac{d^2\varphi(a+x)}{dx^2} +$, &c.: or, by transferring the terms to the other side we shall have $\varphi(a+x) = \varphi(a) + \frac{x}{1}\cdot\frac{d.\varphi(a+x)}{dx} - \frac{x^2}{1\cdot 2}\cdot\frac{d^2\varphi(a+x)}{dx^2} +$, &c.

From the form which we have here given to the development, a number of consequences can be derived; and among these we shall first notice the theorem of Bernoulli.

If we take $a = o$, then will $\varphi(x) = \varphi(o) + \frac{x}{1}\frac{d.\varphi(x)}{dx} - \frac{x^2}{1\cdot 2}\frac{d^2\varphi(x)}{dx} + \frac{x^3}{1\cdot 2\cdot 3}\cdot\frac{d^3\varphi(x)}{dx^3} +$, &c. and if $\varphi(x)$ represent the area of a curve, of which x and y are the coordinates, then $\varphi(x) = \int y\,dx$; $\frac{d\varphi x}{dx} = y$; $\frac{d^2\varphi(x)}{dx^2} = \frac{dy}{dx}$ &c. and $\int y\,dx = \varphi(o) + xy - \frac{x^2}{1\cdot 2}\frac{dy}{dx} + \frac{x^3}{1\cdot 2\cdot 3}\frac{d^2y}{dx^2} -$, &c.; where the quantity $\varphi(o)$ represents the constant, requisite for completing the integral.

We shall next proceed to consider the form which the binomial $(a+x)^n$ takes when subjected to this new species of development. Here we have $d.\frac{\varphi(a+x)}{dx} = n\cdot(a+x)^{n-1}$; $\frac{d.^2\varphi(a+x)}{dx^2} = n.\ n-1.\ (a+x)^{n-2}$; &c. and thence we shall find $(a+x)^n = a^n + \frac{n}{1}\cdot x\cdot(a+x)^{n-1} - \frac{n.\,n-1}{1\cdot 2}\,x^2.\,(a+x)^{n-2} +$ &c.

This

This equation can be easily put under the form $(a + x)^n$ $= a^n + \frac{n}{1} \cdot \frac{x}{a + x} \cdot (a + x)^n - \frac{n.\,n-1}{1\cdot 2} \cdot \frac{x^2}{(a+x)^2} \cdot (a + x)^n + \frac{n.\,n-1.\,n-2}{1\cdot 2\cdot 3} \cdot \frac{x^3}{(a + x^3)} \cdot (a + x)^n -$ &c. and thence we calculate $(a + x)^n \cdot \left(1 - \frac{n}{1} \cdot \frac{x}{a + x} + \frac{n.\,n-1}{1\cdot 2} \cdot \frac{x^2}{(a+x)^2} - \frac{n.\,n-1.\,n-2}{1\cdot 2\cdot 3} \cdot \frac{x^3}{(a+x)^3} + \text{&c.}\right) = a^n$; or, by a very simple transposition, we arrive at the following result: $a^n \cdot (a + x)^{-n} = 1 - \frac{n}{1} \cdot \frac{x}{a+x} + \frac{n.\,n-1}{1\cdot 2} \cdot \frac{x^2}{(a+x)^2} - \frac{n.\,n-1.\,n-2.}{1\cdot 2\cdot 3} \cdot \frac{x^3}{(a+x)^3} +$ &c.

This expression, were it only for the singular manner in which we have obtained it, is certainly worthy of attention; but besides this, it evidently furnishes a more convergent series for the extraction of roots, than that which is procured from the ordinary development of the binomial. For if we change n into $-n$, we have $(a + x)^n = a^n \cdot \left(1 + \frac{n}{1} \cdot \frac{x}{a+x} + \frac{n.\,n+1}{1\cdot 2} \cdot \frac{x^2}{(a+x)^2} + \frac{n.\,n+1.\,n+2.}{1\cdot 2\cdot 3} \cdot \frac{x^3}{(a+x)^3} + \text{&c.}\right)$ and, putting $x = 1$, the form of the equation is changed into $(a + 1)^n = a^n \cdot \left(1 + \frac{n}{a+1} + \frac{n.\,n+1}{1\cdot 2.\,(a+1)^2} + \frac{n.\,n+1.\,n+2}{1\cdot 2\cdot 3\cdot (a+1)^3} + \text{&c.}\right)$ where the series is always the more convergent as a is the larger.

We shall next apply the general theorem $\varphi\,(a + x) = \varphi\,(a) + \frac{x}{1} \cdot \frac{d.\,\varphi\,(a+x)}{dx} - \frac{x^2}{1\cdot 2} \cdot \frac{d^2\,\varphi\,(a+x)}{dx^2} +$ &c. to the determination of the sine and cosine of $a + x$; and in the first instance making $\varphi\,(a + x) =$ Sin. $a + x$, we have $\frac{d.\,\varphi\,(a+x)}{du} =$ Cos. $a + x$; $\frac{d^2\,\varphi\,(a+x)}{du^2} = -$ Sin. $a + x$; $\frac{d^3\,\varphi\,(a+x)}{du^3} = -$ Cos. $(a + x)$; &c.: and substituting

these

these values in the preceding formula we shall find Sin. $a + x$ = Sin. $a + \frac{x}{1}$. Cos. $a + x + \frac{x^2}{1 \cdot 2}$. Sin. $a + x - \frac{x^3}{1 \cdot 2 \cdot 3}$. Cos. $a + x - \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4}$. Sin. $a + x + \frac{x^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5}$. Cos. $a + x +$ &c.; and arranging the terms of this equation according to the sine and cosine of $a + x$ we have, Sin. $a + x$. $\left(1 + \frac{x^2}{1 \cdot 2} + \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4} - \text{&c.}\right)$ − Cos. $a + x$. $\left(\frac{x}{1} - \frac{x^3}{1 \cdot 2 \cdot 3} + \frac{x^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5} - \text{&c.}\right)$ = Sin. a. Now if we develop Sin x and Cos. x by Taylor's theorem, we shall find

$$\text{Sin. } x = \frac{x}{1} - \frac{x^3}{1 \cdot 2 \cdot 3} + \frac{x^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5} - \text{&c.}$$

$$\text{Cos. } x = 1 - \frac{x^2}{1 \cdot 2} + \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4} - \text{&c.;}$$

and putting these values into the former result, we obtain the following property of the functions, viz. Sin. $a + x$. Cos. x − Cos. $a + x$. Sin. x = Sin. a.

We now proceed to consider the development of the Cos. $a + x$; and having in this case $\varphi(a + x)$ = Cos. $a + u$; $\frac{d\varphi(a+x)}{du} = -$ Sin. $a + x$; $\frac{d^2\varphi(a+x)}{du^2} = -$ Cos. $a + x$; $\frac{d^3.\varphi(a+x)}{du^3}$ = Sin. $a + x$; &c. we calculate Cos. $a + x$ = Cos. $a - \frac{x}{1}$. Sin. $a + x + \frac{x^2}{1 \cdot 2}$ Cos. $a + x + \frac{x^3}{1 \cdot 2 \cdot 3}$. Sin. $a + x - \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4}$ Cos. $a + x - \frac{x^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5}$ Sin $a + x +$ &c.; and putting this result under the form Cos. $a + x$. $\left(1 - \frac{x^2}{1 \cdot 2} + \frac{x^4}{1 \cdot 2 \cdot 3 \cdot 4} - \text{&c.}\right)$ + Sin. $a + u$. $\left(\frac{x}{1} - \frac{x^3}{1 \cdot 2 \cdot 3} + \frac{x^5}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5} - \text{&c.}\right)$ = Cos. a, we obtain this other property of these functions: Cos. $a + x$. Cos. x + Sin. $a + x$. Sin. x = Cos. a.

From

From the two equations

(1). Sin. $a + x$. Cos. x — Cos. $a + x$. Sin. x = Sin. a.
(2). Cos. $a + x$. Cos. x + Sin. $a + x$. Sin. x = Cos. a.

we can easily deduce two other equations which have been usually considered as the foundation upon which the whole theory of these functions rests. These equations are

Sin. $a + x$ = Sin. a. Cos. x + Cos. a. Sin. x.
Cos. $a + x$ = Cos. a. Cos. x. — Sin. a. Sin. x;

and to have a demonstration of them, we multiply equation (1) by the cos. x, and equation (2) by the sin. x: then by adding these two products together, we shall find Sin. $a + x$. (Cos^2. x + Sin^2. x) = Sin. a. Cos. x + Cos. a. Sin. x. and as the sum of the squares of the sine and cosine is equal to the square of the radius (equal to unity), we have Sin. $a + x$ = Sin. a. Cos. x + Cos. a. Sin. x. Again, if we multiply equation (1) by the sin. x, and equation (2) by the cos. x, and if we subtract the latter product from the former, we shall have Cos. $a + x$. (Cos^2. x + Sin^2. x.) = Cos. a. Cos. x — Sin. a. Sin x; or Cos. $a + x$ = Cos. a. Cos. x — Sin. a. Sin. x.

The examples which we have now given evidently show the advantage that may sometimes be derived from the development which we have here investigated; and it would not be difficult to adduce other instances to which it might be successfully applied. But as we have accomplished what we originally proposed; namely, to point out the analytical distinction betwixt the two theorems of Bernoulli and Taylor, we shall leave the further consideration of the subject to those who may think it worth the trouble of a more minute examination.

W. S.

XXXIII. *On the Quantity of Carbon in Carbonic Acid, and on the Nature of the Diamond. By* WILLIAM ALLEN, *Esq.* F.L.S. *and* WILLIAM HASLEDINE PEPYS, *Esq.**

THE estimates of the quantity of real carbon in carbonic acid differing very widely, and the experiments of Guyton de Morveau upon the combustion of the diamond, detailed in the 31st volume of the *Annales de Chimie*, being liable to some objections from the manner in which the operations were conducted, we determined to institute a set of experiments, in order, if possible, to settle the question.

Lavoisier, from the result of experiments apparently conducted with much accuracy, concluded that every hundred parts by weight of carbonic acid consisted of 28 carbon and 72 oxygen. This was in a great degree confirmed by the very valuable researches of Smithson Tennant, esq. on the nature of the diamond, an account of which is printed in the Transactions of this Society for the year 1797, and which were made previously to the experiments of Guyton; but notwithstanding this, the result of Guyton's experiment, which only allowed 17·88 per cent. of carbon to carbonic acid, has been adopted in all the systems of chemistry to the present time.

In researches of this nature, the results are much influenced by slight variations in the quality of the gas; but having had repeated experience of the accuracy of the eudiometer (Pepys's) described in this volume†, we were enabled to proceed in this respect with great confidence.

Our object was, to consume certain known quantities of diamond and other carbonaceous substances in oxygen gas, and we at first determined to employ the sun's rays, by means of a powerful lens; but considering the uncertainty of a favourable opportunity in this country, and at the season in which our experiments were made, we resolved to employ the apparatus represented by the drawing.

* From the *Transactions of the Royal Society* for 1807.

† See p. 119 of the present volume of our Magazine.

Descrip-

Description of the Apparatus.

This consisted of two mercurial gasometers, fig. 1 and 2, each capable of containing from 70 to 80 cubic inches of gas. The internal cylinder CC is of cast iron, and solid, except the perforation through its middle; the external cylinder is also of cast iron; and the glass receiver slides up and down in the space between them, which is filled with mercury: not more than sixteen pounds are required for each, and the small bath B, fig. 1.

To the top of each receiver, a graduated scale or register H, is screwed, showing the number of cubic inches of gas, measuring from the upper edge of the external iron cylinder. The level of the mercury is ascertained by a small glass gauge. The registers were graduated by throwing up one cubic inch of gas at a time.

The gasometers stand upon mahogany stools, perforated for a socket, to which, according to the nature of the experiment, a small receiver R, or the triple socket TS, or any other combination, may be united.

P represents the platina tube with its furnace; the ends of the tube are mounted with female screws of brass, to one of which the accommodating screw socket AS was joined.

T is a double section of the platina tray which contained the substances to be heated. During their combustion, it was made to slide easily within the platina tube P. The accommodating socket and platina tray are drawn considerably larger in proportion than the instrument.

By means of the triple socket and the cocks, the gas was made to pass freely over the substances in combustion, from one gasometer to the other; and by shutting off the communication with the platina tube, while that with the small receiver was open, any portion of gas in the gasometer, fig. 1. might be transferred into eudiometers or measures standing in the mercury bath M, for examination.

In order to discover whether the several sockets were air-tight, after the apparatus was put together, the communication with the gasometer, fig. 1. was closed, and the other communications opened; the receiver of the gasometer, fig. 2, being raised, drew up a column of mercury in the small

receiver

receiver R, equal to two inches: the communication with the gasometer was then closed, and the column was supported without alteration. This was always tried previous to, and after every experiment. As the joints would bear this degree of exhaustion, we were confident they would resist a much greater pressure than we had any occasion to employ. The glass tubes GG, which connected the platina tube with the gasometers, enabled us to observe any flash arising from the combustion of hydrogen which might be contained in the substances subjected to experiment. In order to avoid prolixity, we shall generally state the method which was invariably followed.

We soon found that oxygen gas, even when secured in bottles with ground glass stoppers, was not always to be depended upon, but was sensibly deteriorated by keeping; and therefore in all our experiments we made the gas within an hour or two of the time of using it, and always from the hyperoxygenised muriate of potash. Its degree of purity was constantly ascertained by the eudiometer before every experiment, and was generally determined in about 10 minutes. The solution employed was that recommended by professor Davy; namely, the solution of green sulphate of iron saturated with nitrous gas*; and whenever the diminution had arrived at its maximum, and the gas began to increase in volume, we substituted a simple solution of the green sulphate of iron for that saturated with nitrous gas, and always had the most satisfactory results: for the simple sulphate absorbs any nitrous gas which may have escaped from the saturated solution, and the residuum in this case enables us to ascertain exactly the quantity of oxygen contained in the gas.

We determined to make our first experiment with charcoal, and as Morozzo and Rouppe had ascertained the absorbing properties of this substance, and as our results must obviously be influenced by it, our attention was directed to this point.—The following quantities of different kinds of wood, sawed into slips $\frac{2}{10}$ of an inch were weighed:—

* This solution absorbs oxygen much more rapidly in warm weather than in cold.

White

White fir - -	300 grains.
Lignum vitæ -	800 grains.
Box - -	400
Beech - -	500
English Oak -	250
Mahogany -	200

These slips were put into small crucibles, and completely covered with dry sand. Heat was very gradually applied at first, until the volatile parts were dissipated; they were then kept about 40 minutes in a white heat. On being collected and weighed, while still warm, the charcoal from each was as follows:

Fir - -	54·5 grs.	equal to	181·7 per cent.
Lignum vitæ	138 -	-	17·25
Box -	81 -	-	20·25
Beech -	75 -	-	15
Oak -	43·5 -	-	17·40
Mahogany	31·5 -	-	15·75

These being exposed to the air during one week, increased n weight thus:

Fir - - -	13 per cent.
Lignum vitæ -	9·6
Box - - -	14
Beech - -	16·3
Oak - - -	16·5
Mahogany -	18

Certain quantities being confined in common air increased very little in weight, and all in the same proportion; we are therefore much inclined to think that this increase is owing to an absorption of water from the air; and we repeatedly found that the greatest increase of weight took place in the first hour or two after exposure, and arrived at its maximum in less than 24 hours, as the following experiment, selected from several others, will prove.

40 grains of charcoal from willow wood, which had been put into a bottle with a ground glass stopper immediately after they were removed from the fire, were exposed in the scale of a delicate balance, in a room where the thermometer was 62° Fahrenheit, barometer 30·26.

6 6 o'clock

	Grains.	Total increase.	Time.
6 o'clock P. M.	40		
½ past -	40·7 + ·7		
7 - -	41·3 + ·6 =	1,3	1 hour.
½ past -	41·6 + ·3 =	1,6	1½ hours.
8 - -	41·8 + ·2 =	1,8	2 hours.

The pieces were now spread out on paper after every weighing, to expose them more completely.

½ past 8 -	42·5 + ·7 =	2·5	2½ hours.
9 - -	42·8 + ·3 =	2·8	3 hours.
½ past -	43·1 + ·3 =	3·1	3½ hours.
10 - -	43·3 + ·2 =	3·3	4 hours.
½ past -	43·4 + ·1 =	3·4	4½ hours.

Here it was left all night.

10 A. M. -	45 + 1·6 =	5	16 hours.
4 P. M. -	45		
6 - -	44·5 − ·5 =	4·5	24 hours.
9 - -	44·4 − ·1 =	4·4	27 hours.

Next day.

½ past 8 A. M.	44·9 + .5 =	4·9	38½ hours.
½ past 1 P. M.	44·7 − ·2 =	4·7	43½ hours.
10 - -	44·5 − ·2 =	4·5	52 hours.

Hence charcoal seems to act as an hygrometer: its greatest increase was 5 grains on 40, or 12½ per cent. And in order to ascertain to what the increase of weight was owing, we put 27·25 grains of charcoal, which had been thus exposed, into a small bottle and tube connected with a receiver standing in the mercury bath, the whole of the vessels being also filled with mercury in order to exclude common air. Heat applied by an Argand's lamp produced gas equal to about half the bulk of the charcoal; but as soon as the temperature of the mercury rose to 214° Fahrenheit, elastic fluid streamed from every piece of charcoal, which quickly condensed, and ½inch of the tube was occupied with water. This proved that our suspicion of the increase of weight being principally attributable to water, was well founded.

The result of these, and other experiments, plainly pointed out the precautions which were necessary in order to obtain an accurate result with charcoal; for if we had weighed

4 grains

4 grains of the charcoal a few hours after it was made, we should only in fact have had 3·5 grains of real charcoal and our calculations would have been erroneous. To avoid this source of error, we subjected our charcoal to a red heat immediately before using it, and also weighed it as speedily as possible; in fact while it was still warm. It may be proper to state, that our weights were such as we could thoroughly depend upon.

The volume of gas being so much influenced by temperature and pressure, these were noted during every experiment; and thermometer 60° Fahrenheit, barometer 30°, were assumed as the standard. Gay Lussac remarks, that from 32° to 212° Fahrenheit, dry air expands 0·00208, or $\frac{1}{480}$ part of its bulk for every degree of the thermometer. Dalton makes it 0·000207, or $\frac{1}{483}$ part; we therefore divided the whole quantity of gas by 480, and multiplied the quotient by the degrees of difference under 60°.

It being of great consequence in these experiments to know the exact weight of a given quantity of oxygen and carbonic acid gases, we resolved to examine for ourselves, whether the statements already given were quite correct, and accordingly made carbonic acid over mercury from Carrara marble and diluted sulphuric acid, which being tried with lime water in Pepys's eudiometer, was all absorbed in 3 minutes except 1 part in 100. We used two charges of lime water, though one would have been sufficient.

A glass globe being exhausted by an excellent air pump, was exactly balanced on a beam sensible to a minute portion of a grain; then being screwed upon one of the glass receivers of the mercurial gasometer previously filled with carbonic acid gas, 21 cubic inches entered. The globe was now increased in weight by 10·2 grains. In order to be certain we repeated the experiment, with exactly the same results. The 21 cubic inches were to be brought to the mean temperature and pressure, as the thermometer stood at 44° Fahrenheit, the barometer 29·86.

21	480)21·00(0·043	60°
·68 add for temp.	16	44
21·68	0·688 add for temp.	16 diff.

Correction for pressure.

30 : 29·86 : : 21·68 : 21·58.

The volume therefore at mean temperature and pressure would have been 21·58 cubic inches.

21·58 : 10·2 : : 100 : 47·26

Consequently 100 cubic inches of carbonic acid gas at mean temperature and pressure weigh 47·26 grains.

We next tried oxygen gas from the hyperoxygenised muriate of potash made over mercury, and which, by the eudiometer, left only a residuum of 2 parts in 100. The glass globe exhausted as before, and weighed, was screwed on to the glass receiver of the mercurial gasometer containing oxygen, and 21 cubic inches entered, by which it increased in weight 7·3 grains. This experiment was repeated with exactly the same result. The thermometer and barometer remaining the same, we take the volume as before corrected.

21·58 cubic inches.

21·58 : 7·3 : : 100 : 33·82.

Then 100 cubic inches of oxygen gas at mean temperature and pressure weigh 33·82 grains. After these experiments we examined Davy's researches on nitrous oxide, and had the satisfaction to find that his estimate, both of carbonic acid and oxygen gases, agreed almost exactly with ours.

The next point was to ascertain whether lime-water would take the whole of the carbonic acid gas from a mixture with oxygen, or common air; we therefore mixed a known quantity of carbonic acid gas with a certain quantity of common air, and on trying it with our eudiometer and lime-water, the whole of the carbonic acid gas was in a short time absorbed. We also found, that though the solution of green sulphate, saturated with nitrous gas, would not take up the whole of the carbonic acid gas, yet the simple green

green sulphate, merely by its water of solution, absorbed i very readily.

It may be proper to notice here, that though we repeated ly tried the oxygen procured from hyperoxygenised mu riate of potash by the eudiometer and lime-water, it neve gave the least trace of carbonic acid.

Experiment with Charcoal from Box-wood.

The thermometer being at 42° Fahrenheit, barometer at 30·2, we kept some box-wood charcoal red hot for a considerable time under sand, and weighed four grains as expeditiously as possible; this being put into the platina tray, was pushed to the middle of the platina tube; the oxygen (made from hyperoxygenised muriate of potash over mercury) was contained in gasometer No. 1; No. 2 was empty. Every thing being adjusted and found perfectly air-tight, the communication with the small receiver R was closed, and the common air contained in the tubes and sockets, amounting only to 2·84 cubic inches, was driven out by a pressure of oxygen from gasometer No. 1: when several cubic inches had passed into gasometer No. 2, the gas was let out by opening the cock at the top of its glass receiver, and pressing it down; the cock being then closed, the gasometer No. 2, was completely empty, and the whole of the gas from No. 1, was driven through the tubes into No. 2, and back again. The common air having been previously withdrawn from the small receiver R, we tried the purity of our oxygen by the eudiometer in the manner before described, and found a residuum of 3 parts in 100: we then disengaged as much gas as reduced the quantity to 47 cubic inches by the register or scale; to this must be added the contents of the tubes and sockets 2·84 cubic inches, making the total quantity of oxygen employed 49·84 cubic inches.

Correction for temperature.

49·84	480) 19·84 (0·103		60°
1·85 for temp.	18		42
51·69	1·854 add for temp.		18 diff.

Cor-

Correction for pressure.

30 : 30·2 : : 51·69 : 52·03.

The volume, therefore, at mean pressure and temperature, would have been 52·03 cubic inches.

We now lighted a fire in the small black lead furnace under the platina tube, and as soon as it became red hot, opened the cocks and passed the gas from No. 1 to No. 2, when the charcoal entered into vivid combustion, and heated the platina tube white hot. The operation was repeated many times during six or seven minutes, by pressing alternately upon the glasses of the gasometer. Not the least flash of light was observable in the glass connecting tubes G G, nor the smallest appearance of moisture. The furnace being removed, the tube was now cooled by the application of wet cloths; and when all was reduced to the temperature of the room, we pressed upon the glass of gasometer No. 2, so as to force all the gas into No. 1.* The cock below being closed, we tried the tubes, &c. and found them perfectly air-tight. We next unscrewed the tube and took out the platina tray; but it only contained a light white ash, somewhat resembling the shape of the pieces of charcoal, and weighing only ·02 of a grain. On observing the register of No. 1, it indicated exactly the quantity of gas that we began with, so that although 3·98 grains of charcoal had been dissolved, the volume of gas was unaltered by it; a circumstance which had been remarked before by Lavoisier. The small receiver R was now nearly full of mercury; the communication with the gasometer being opened, the large glass receiver was gently pressed upon, until several cubic inches were forced through the receiver R, and tube K, in order to clear the latter of common air. This being done, on trying our gas with the eudiometer and lime water, 56 parts were absorbed out of 100. These of course were carbonic acid gas; the test for oxygen absorbed 41, and a residuum of 3 was left, which was exactly what we began with. This is a striking proof that nothing but carbonic acid was produced in the experiment.

100 : 56 : : 52·03 : 29·13.

Then 29·13 cubic inches of carbonic acid gas were produced.

100 : 47·26 : : 29·13 : 13·76.

These 29·13 cubic inches of carbonic acid gas would therefore weigh 13·76 grains.

The charcoal weighed	4	grains.
The residual white ash,	0·02	
Charcoal consumed	3·98	grains.

Then, if 13·76 grains, the weight of the carbonic acid procured, contain 3·98 of charcoal, 100 grains must contain 28·92.

13·76 : 3·98 : : 100 : 28·92.

Then, according to this experiment, 100 grains of carbonic acid gas contain 28·92 charcoal.

The gas before the experiment consisted of

Oxygen	50·47 cubic inches.
Azote	1·56
	52·03

After the experiment,

Carbonic acid	29·13 cubic inches.
Oxygen	21·34
Azote -	1·56
	52·03

Now as the volume of gas was unaltered, it will be fair to consider the quantity of oxygen gas consumed as equal to the carbonic acid produced, or 29·13 cubic inches.

Then, if 100 cubic inches of oxygen weigh 33.82 grains, 29·13 cubic inches will weigh 9·85 grains.

100 : 33·82 : : 29·13 : 9·85.

The weight of oxygen consumed was therefore 9.85 grains.

Charcoal consumed - - -	3·98
Carbonic acid from this statement	13·83 grains.
Do. by calculations on carbonic acid gas	13·76
	·07

13·83 : 3·98 : : 100 : 28·77.

Thus, calculating by the oxygen consumed, 100 grains of carbonic acid gas contain 28·77 charcoal.

First Experiment on Diamond.

Thermometer 56° Fahrenheit, barometer 30·20.

Our oxygen was made as in the former experiment: it contained no carbonic acid; and on being tried with the impregnated green sulphate left a residuum of 3 parts in 100.

Having selected nine of the clearest and most transparent Brazil diamonds, we found they weighed 3·95 grains. These were ranged in the platina tray, which was placed in the tube, and the whole apparatus, adjusted as before, was perfectly air-tight. The quantity of oxygen was 49·84 cubic inches, as in the last experiment. The same precautions were used to secure accuracy in the results as in the former experiment; and it would only be an unnecessary intrusion on the time of the Society to repeat them. The platina tube was heated red-hot, and kept so for ten minutes; during this time the gas was repeatedly passed from one gasometer to the other; the tube did not become white hot, as in the experiment with charcoal, because in this case the combustion went on more slowly. When every thing was cooled to the temperature of the room, the gas was all passed into No. 1, by pressing down the receiver of No. 2, and the volume was precisely the same as when we began the experiment. On drawing out the tray we observed that some of the diamonds were reduced to a minute speck, and all of them resembled opake white enamel: there was no discoloration in the tray, nor any residual ash whatever; the unconsumed parts weighed 1·46 grains; the original weight was

3·95
1·46

consequently 2·49 grains were consumed.

We could not perceive any dullness on the surface of the mercury in the gasometers, or any appearance of moisture.

On introducing lime-water to a hundred parts of the gas in the eudiometer, a dense white precipitate was formed, and 36 parts absorbed; the test for oxygen absorbed 60, and a residuum of 4 was left.

Correction for temperature.

60°	480)49 84(0·103	49·84	
56	4	·41	add for temp.
4 difference.	·412	50·25	

Correction for pressure.

30 : 30·20 : : 50·25 : 50·58.

The quantity of oxygen at the mean was 50·58 cubic inches.

100 : 36 : : 50·58 : 18·00 cubic inches.

The quantity of carbonic acid gas produced was 18·20 cubic inches.

100 : 47·26 : : 18·20 : : 8·60 grains.

8·60 : 2·49 : : 100 : 28·95.

Then 100 grains of carbonic acid gas contain 28·95 of diamond.

Calculation by oxygen.

100 : 33·82 : : 18·20 : 6·15 grains of oxygen consumed.

2·49 grains of diamond.

8·64

Calculat. by carbonic acid 8·60

·04 difference.

8·64 : 2·49 : : 100 : 28·81.

Thus, if we calculate upon the oxygen consumed, 100 grains of carbonic acid gas contain 28·81 of diamond.

[To be continued.]

XXXIV. *Account of the Discoveries made by the Rev. Dr. Buchanan, in the course of his Investigations undertaken by Order of the Supreme Government of Bengal.*

The Rev. Dr. Buchanan, who left Bengal some months ago, with the view of proceeding to Travancore, to inquire into the state of the Syrian Christians, arrived in that country about the beginning of November last, having travelled from Calcutta to Cape Comorin by land. His highness the rajah of Travancore was pleased to afford to Dr. Buchanan the most liberal assistance in the prosecution of his inquiries. About the middle of November, Dr. Buchanan proceeded from the sea-coast into the interior of the country, north-east from Quilon, to visit the antient Syrian churches, situated amongst the low hills at the bottom of the high ghauts, which divide the Carnatic from Malayala. The face of the country in general, in the vicinity of the mountains, exhibits a varied scene of hill and dale, and winding streams. These streams fall from the mountains, and preserve the valleys in perpetual verdure. The woods produce pepper, cardamoms, and cassia, or wild cinnamon; also frankincense and other aromatic gums. What adds much to the grandeur of the scenery in this country is, that the adjacent mountains of Travancore are not barren, but are covered with teak forests, producing the largest timber in the world.

The first view of the Christian churches in this sequestered region of Hindostan, connected with the idea of their tranquil duration for so many ages, cannot fail to excite pleasing emotions in the mind of the beholder. The form of the oldest buildings is not unlike that of some of the old parish churches in England; the style of building in both being of Saracenic origin. They have sloping roofs, pointed arch windows, and buttresses supporting the walls. The beams of the roof being exposed to view, are ornamented; and the cieling of the choir and altar is circular and fretted. In the cathedral churches the shrines of the deceased bishops

are placed on each side of the altar. Most of the churches are built of a reddish stone, squared and polished at the quarry; and are of durable construction, the front wall of the largest edifices being six feet thick. The bells of the churches are cast in the founderies of Travancore. Some of them are of large dimensions, and have inscriptions in Syriac and Malayalim. In approaching a town in the evening, the sound of the bells may be heard at a distance amongst the hills: a circumstance which causes the British traveller to forget for a moment that he is in Hindostan, and reminds him of another country. When Dr. Buchanan arrived at the remote churches, he was informed by the inhabitants that no European had, to their knowledge, visited the place before. The Romish priests do not travel thither, there being no church of their communion in that quarter.

The number of Syrian churches is greater than has been supposed. There are at this time fifty-five churches in Malayala*, acknowledging the patriarch of Antioch. The church was erected by the present bishop, in 1793.

The Syrian Christians are not Nestorians. Formerly, indeed, they had bishops of that communion; but the liturgy of the present church is derived from that of the early church of Antioch, called *Liturgia Jacobi Apostoli*. They are usually denominated *Jacobitæ;* but they differ in ceremonial from the church of that name in Syria, and indeed from any existing church in the world. Their proper designation, and that which is sanctioned by their own use, is *Syrian Christians*, or *The Syrian Church of Malayala*.

The doctrines of the Syrian church are contained in a very few articles; and are not at variance, in essentials, with the doctrines of the church of England. Their bishops and metropolitan, after conferring with his clergy on the subject, delivered the following opinion: "That an union with the English church, or at least such a connection as should appear to both churches practicable and expedient, would be

* Malayala comprehends the mountains, and the whole region within them, from Cape Cogmorin to Cape Illi, whereas the province of Malabar, commonly so called, contains only the northern districts, not including the country of Travancore.

a happy event, and favourable to the advancement of religion." It is in contemplation to send to England some of the Syrian youth for education and ordination.

The present bishop, Mar Dionysius, is a native of Malayala, but of Syrian extraction. He is a man of respectable character in his nation, and exercises himself in the pious discharge of the duties of his high office. He is now seventy-eight years of age, and possesses a venerable aspect, his white beard descending low to his girdle. On public occasions he wears the episcopal mitre, and is robed in a white vestment, which covers long garments of red silk; and in his hand he holds the pastoral staff. The first native bishop was ordained by the Romish church in 1663; but he was of the Romish communion. Since that period the old Syrians have continued, till lately, to receive their bishops from Antioch: but that antient patriarchate being now nearly extinct, and incompetent to the appointment of learned men, the Christian church in Malayala looks henceforth to Britain for the continuance of that light which has shone so long in this dark region of the world.

From the information given by the Syrian Christians, it would appear that the churches of Mesopotamia and Syria, (215 in number), with which they are connected, are struggling with great difficulties, and merely owe their existence to some deference for their antiquity; and that they might be expected soon to flourish again, if favoured with a little support. It would be worthy the church of England to aid the church of Antioch in her low estate. The church of England *is now* what the church of Antioch *once was*. The mode in which aid can be best afforded to Christians under a foreign power in the East, is not chiefly by contributions of money, but by representing to those governments, with which we may have friendly intercourse, that these Christians are of the same religion with ourselves; and that we are desirous that they should be respected. The argument, from the sameness of religion, is well understood by all Asiatic princes, and can never fail when seriously proposed; for they think it both natural and obligatory that every government should be interested in those who are of its own religion

religion. There are two circumstances which invite us to turn our eyes to the country of "the first generations of men." The tolerant spirit of the Wahabian Mahomedans is a fair prognostic; and promises to aid our endeavours to restore to an antient community of Christians the blessings of knowledge and religious liberty. Another favourable circumstance is, that some of the churches in Mesopotamia, in one of which the patriarch of Antioch now resides, are said still to remain in their pristine state, and to have preserved their archives and antient manuscript libraries. A domestic priest of the patriarch, now in Cochin, vouches for the truth of this fact. We know from authentic history that the churches between the rivers escaped the general desolation of the Mahomedan conquest, in the seventh century, by joining arms with the Mahomedans against the Greek Christians, who had been their oppressors. The revival of religion and letters in that once highly-favoured land, in the heart of the antient world, would be, in the present circumstances of mankind, an auspicious event.

The Syrian Christians in Malayala still use the Syriac language in their churches: but the Malayalim, or proper Malabar (a dialect distinct from the Tumul), is the vernacular tongue. They have made some attempts to translate the Syriac scriptures into Malayalim; but have not hitherto had the suitable means of effecting it. When a proposal was made of sending a Malayalim translation to each of their fifty-five churches, as a standard book, on condition that they would transcribe it, and circulate the copies among the people,—the elders replied, That so great was the desire of the people in general to have the Bible in the vulgar tongue, that it might be expected that every man *who could write* would make a copy on *ollas* (palm leaves) for his own family.

It ought to be mentioned, to the praise of the present bishop of the Romish church on the coast of Malabar, that he has consented to the circulation of the Scriptures throughout his diocese. The Malayalim translation acquires from this circumstance an increased importance, since there will be now upwards of 200,000 Christians in Malayala

who are ready to receive it. The translation of the New Testament (which it is proposed to print first) has already commenced, under the superintendance of the Syrian bishop. The true cause of the low state of religion amongst the Romish churches on the sea-coast and in Ceylon is, *their want of the Bible.* It is doubtful whether some of the priests know that such a book exists! It is injurious to Christianity in India to call men *Christians* who know not the scriptures of their religion: they might as well be called by any other name. Oral instruction they have none, even from their European priests. The best effects may therefore be expected from the simple means of putting the Bible into their hands. All who are well acquainted with the natives, know that instruction by books is best suited to them. They are in general a contemplative people, and patient in their inquiries; curious also to know what it can be that is of importance enough to be written,—at the same time that they regard written precept with respect. If they possess a book in a language which they understand, it will not be left long unread. In Tanjore, and other places where the Bible is freely given, the Protestant religion flourishes; and produces the happiest effects on the character of the people. In Tanjore the Christian virtues will be found in exercise by the feeble-minded Hindoo, in a vigour and purity which will surprise those who have never known the native character but under the greatest disadvantages. On the Sunday, the people, habited in their best apparel, repair to the parish church, where the solemnity of their devotion in accompanying the public prayers is truly impressive. They sing the old psalm tunes well; and the voice of the full congregation may be heard at a distance. Prayers being ended, they listen to the sermon evidently with deep attention; nor have they any difficulty in understanding it, for they almost all, both men and women, can read their Bible. Many of them take down the discourse on *ollas*, that they may read it afterwards to their families at home*. As soon as the

* It is well known that natives of Tanjore and Travancore can write down what is spoken deliberately, without losing one word. They seldom look at their ollas while writing, and can write in the dark with fluency.

minister

minister has pronounced his text, the sound of the *iron style* on the palm-leaf is heard throughout the congregation. Even the boys of the schools have their ollas in their hands; and may be seen after divine service reading them to their mothers as they pass over the fields homewards. This aptitude of the people to receive and to record the words of the preacher renders it peculiarly necessary that "the priest's lips should keep knowledge." Upon the whole, the moral conduct, upright dealing, decorous manners, and decent dress of the native protestants of Tanjore, demonstrate the powerful influence and peculiar excellence of the Christian religion. It ought however to be observed, that the Bible, when the reading of it becomes general, has nearly the same effect on the poor of every place.

When the Syrian Christians understood that the proposed Malayalim translation was to accord with the English Bible, they desired to know on what *authorities* our translation had been made; alleging, that they themselves possessed a version of undoubted antiquity, namely, that used by the first Christians at Antioch; and that they could not depart from the reading of *that* version. This observation led to the investigation of the antient Syrio-Chaldaic manuscripts in Malayala; and the inquiry has been successful beyond any expectation that could have been formed.

It had been commonly supposed that all the Syriac manuscripts had been burned by the Romish church, at the synod of Udiamper, near Cochin, in 1599; but it now appears that the most valuable manuscripts were not destroyed: the inquisitors condemned many books to the flames; but they saved the Bible. They were content with ordering that the Syriac scriptures should be amended agreeably to the reading of the Vulgate of Rome; and these emendations now appear in black ink, and of modern appearance, though made in 1599: but many Bibles and many other books were not produced at all; and the churches in the mountains remained but a short time subject to Romish dominion (if indeed they can be said to have been at any time subject to it); for the native governments have ever formed a barrier between

tween the inquisition at Goa and the Christians in the mountains.

In the acts of the council of Nice, it is recorded that Joannes, bishop of India, signed his name at that council, A. D. 325. This date corresponds with the Syrian year 636; for the primitive Syrian church does not compute time from the Christian æra, but from Alexander the Great. The Syriac version of the Scriptures was brought to India, according to the belief of the Syrians, before the year 636; and they allege that their copies have ever been exact transcripts of that version, without known error, through every age, down to this day. There is no tradition among them of the churches in the southern mountains having ever been destroyed, or even molested. Some of their present copies are certainly of antient date: though written on a strong thick paper, (like that of some MSS. in the British Museum, commonly called *Eastern paper*,) the ink has, in several places, eaten through the material in the exact form of the letter. In other copies, where the ink had less of a corroding quality, it has fallen off, and left a dark vestige of the letter, faint indeed, but not in general illegible. There is one volume found in a remote church of the mountains, which merits particular description:—it contains the Old and New Testaments, engrossed on strong vellum, in large folio, having three columns in the page, and is written with beautiful accuracy. The character is Estrangelo-Syriac, and the words of every book are numbered. This volume is illuminated, but not after the European manner, the initial letters having no ornament. Prefixed to each book there are figures of principal Scripture characters (not rudely drawn), the colours of which are distinguishable; and in some places the enamel of the gilding is preserved: but the volume has suffered injury from time or neglect, some of the leaves being almost entirely decayed. In certain places the ink has been totally obliterated from the page, and has left the parchment in its natural whiteness; but the letters can, in general, be distinctly traced from the impress of the pen, or from the partial corrosion of the ink. The Syrian church

church assigns to this manuscript a high antiquity; and alleges that it has been for some centuries in the possession of their bishops; and that it was industriously concealed from the Romish inquisition in 1599: but its true age can only be ascertained by a comparison with old manuscripts in Europe of a similar kind. On the margin of the drawings are some old Roman and Greek letters, the form of which may lead to a conjecture respecting the age in which they were written. This copy of the Scriptures has admitted as canonical the epistle of Clement, in which respect it resembles the Alexandrine manuscript: but it has omitted the Revelations,—that book having been accounted apocryphal by some churches during a certain period in the early ages. The order of the books of the Old and New Testament differs from that of the European copies,—this copy adhering less to unity of subject in the arrangement than to chronological order. The very first emendation of the Hebrew text proposed by Dr. Kennicott (Gen. iv. 8.) is to be found in this manuscript. The disputed passage in 1 John, v. 7, is not to be found in it: that verse is interpolated in some other copies in black ink, by the Romish church in 1599.

Thus it appears, that during the dark ages of Europe, while ignorance and superstition in a manner denied the Scriptures of the rest of the world, the Bible found an asylum in the mountains of Malayala; where it was revered and freely read by upwards of 100 churches; and that it has been handed down to the present time under circumstances so highly favourable to accurate preservation, as may justly entitle it to respect, in the collation of doubtful readings of the sacred text.

There are many old Syriac manuscripts besides the Bible, which have been well preserved: for the synod of Udiamper destroyed no volumes but those which treated of religious doctrine or church supremacy. Two different characters of writing appear ever to have been in use among the Syrian Christians, the common Syriac and the Estrangelo. The oldest manuscripts are in the Estrangelo.

But there are other antient documents in Malayala, not less interesting than the Syrian manuscripts. The old Portuguese

tuguese historians relate, that soon after the arrival of their countrymen in India, about three hundred years ago, the Syrian archbishop of Angamalee, by name Mar Jacob, deposited in the fort of Cochin, for safe custody, certain tablets of brass; on which were engraven rights of nobility and other privileges, granted to the Christians by a prince of a former age; and that while these tablets were under the charge of the Portuguese, they had been unaccountably lost, and had never after been heard of. The loss of the tablets was deeply regretted by the Christians; and the Portuguese writer, Gouvea, ascribes their subsequent oppressions by the native powers to the circumstance of their being no longer able to produce their charter. It is not generally known, that at a former period the Christians possessed regal power in Malayala. The name of their last king was Beliarte. He died without issue; and his kingdom descended, by the custom of the country, to the king of Cochin. When Vasco de Gama was at Cochin, in 1503, he saw the sceptre of the Christian king.

It is further recorded by the same historians, that besides the documents deposited with the Portuguese, the Christians possessed three other tablets, containing antient grants, which they kept in their own custody, and that these were exhibited to the Romish archbishop Menezes, at the church of Tevelecar, near the mountains, in 1599, the inhabitants having first exacted an oath from the archbishop, that he would not remove them. Since that period little has been heard of the tablets: though they are often referred to in the Syrian writings, the translation itself has been lost. It has been said that they were seen about forty years ago; but Adrian Moens, a governor of Cochin in 1770, who published some account of the Jews of Malabar, informs us that he used every means in his power for many years to obtain a sight of the Christian plates, and was at length satisfied they were irrecoverably lost, or rather, he adds, that they never existed.

The learned world will be gratified to know that all these antient tablets, not only the three last mentioned exhibited in 1599, but those also (as is supposed) delivered by the Syrian

Syrian archbishop to the Portuguese on their arrival in India, which are the most antient, have been recently recovered by the exertions of lieutenant-colonel Macaulay, the British resident in Travancore; and are now officially deposited with that officer.

The plates are six in number: they are composed of a mixed metal: the engraved page on the largest plate is thirteen inches long, by about four broad. They are closely written: four of them on both sides of the plate, making in all eleven pages. On the plate reputed to be the oldest, there is writing perspicuously engraved in nail-headed or triangular-headed letters, resembling the Persepolitan or Babylonish. On the same plate there is writing in another character, which has no affinity with any existing character in Hindostan. The grant on this plate appears to be witnessed by four Jews of rank, whose names are distinctly written in an old Hebrew character, resembling the alphabet called the Palmyrene; and to each name is prefixed the title of Magen; that is, chief.

It may be doubted whether there exists in the world another document of equal antiquity, which is at the same time of so great a length and in such faultless preservation, as the Christian tablets in Malayala. The Jews of Cochin indeed contest the palm of antiquity and of preservation; for they also produce tablets containing privileges granted at a remote period. The Jewish tablets are two in number. The Jews were long in possession of a third plate, which now appears to be the property of the Christians. The Jews commonly show an antient Hebrew translation of their plates. Dr. Leyden made another translation, which differs from the Hebrew: and there has lately been found among the old Dutch records at Cochin, a third translation, which approaches nearer to Dr. Leyden's than to the Hebrew. In a Hebrew manuscript, which will shortly be published, it is recorded that a grant on brass tablets was given to the Jews in A. D. 379.

As it is apprehended that there may be some difficulty in obtaining an accurate translation of all these tablets, it is proposed to print a copper-plate fac-simile of the whole, and

and to transmit copies to the learned societies in Hindostan and in Europe: for this purpose an engraver is now employed on the plates at Cochin. The Christian and Jewish plates together will make fourteen pages. A copy has been sent, in the first instance, to the pundits at the Shanscrit college at Trichiur, by direction of the rajah of Cochin.

When the White Jews at Cochin were questioned respecting the antient copies of their Scriptures, they answered, that it had been usual to bury the old copy read in the synagogue, when decayed by time and use. This, however, does not appear to have been the practice of the Black Jews, who were the first settlers; for in the record-chests of their synagogues, old copies of the law have been discovered; some of which are complete, and for the most part legible. Neither could the Jews of Cochin produce any historical manuscripts of consequence, their vicinity to the sea-coast having exposed their community to frequent revolution: but many old writings have been found at the remote synagogues of their antient enemies the Black Jews, situated at Tritooa, Paroor, Chenotta, and Maleh, the last of which places is near the mountains. Amongst these writings are some of great length, in Rabbinical Hebrew; but in so antient and uncommon a character, that it will require much time and labour to ascertain their contents. There is one manuscript written in a character resembling the Palmyrene Hebrew on the brass plates: but it is in a decayed state, and the leaves adhere so closely to each other, that it is doubtful whether it will be possible to unfold them and preserve the reading. It is sufficiently established by the concurring evidence of written record and Jewish tradition, that the Black Jews had colonized on the coasts of India long before the Christian æra. There was another colony at Rajapoor, in the Mahratta territory, which is not yet extinct; and there are at this time Jewish soldiers and Jewish native officers in the British service. That these are a remnant of the Jews of the first dispersion at the Babylonish captivity, seems highly probable. There are many other tribes settled in Persia, Arabia, Northern India, Tartary, and China, whose respective places of residence may be

easily

easily discovered. The places which have been already ascertained are sixty-five in number. These tribes have in general (particularly those who have passed the Indus) assimilated much to the customs of the countries in which they live; and may sometimes be seen by a traveller, without being recognised as Jews. The very imperfect resemblance of their countenance to the Jews of Europe, indicates that they have been detached from the parent stock in Judea, many ages before the race of Jews in the West. A fact corroborative of this is, that certain of these tribes do not call themselves Jews, but Beni-Israel or Israelites; for the name Jew is derived from Judah; whereas the ancestors of these tribes were not subject to the kings of Judah, but to the kings of Israel. They have in most places the book of the Law, the book of Job, and the Psalms; but know little of the Prophets. Some of them have even lost the book of the Law, and only know that they are Israelites from tradition, and from their observance of peculiar rites.

A copy of the Scriptures belonging to the Jews of the East, who might be supposed to have no communication with the Jews in the West, has been long a desideratum with Hebrew scholars. In the coffer of a synagogue of the Black Jews, in the interior of Malayala, there has been found an old copy of the Law, written on a roll of leather. The skins are sewed together, and the roll is about fifty feet in length. It is in some places worn out, and the holes have been patched with pieces of parchment. Some of the Jews suppose that this roll came originally from Senna, in Arabia; others have heard that it was brought from Cashmir. The Cabul Jews, who travel annually into the interior of China, say, that in some synagogues the Law is still found written on a roll of leather; not on vellum, but on a soft flexible leather, made of goats' skin, and dyed red; which agrees with the description of the roll above mentioned.

Such of the Syriac and Jewish manuscripts as may, on examination, be found to be valuable, will be deposited in the public libraries of the British universities.

The princes of the Deccan have manifested a liberal regard for the extension of Shanscrit learning, by furnishing lists

lists of the books in their temples for the college of Fort William in Bengal. His excellency the rajah of Tanjore was pleased to set the example, by giving the voluminous catalogue of the antient library of the kings of Tanjore; and his example has been followed by the ranny of Ramnad, patroness of the celebrated temple of Ramisseram, near Adam's Bridge; by his highness the rajah of Travancore, who has given lists of all the books in the Travancore country; and by the rajah of Cochin, patron of the antient Shanscrit college, at the temple of Trichiur. It is understood that a copy of any book in these catalogues will be given when required. The brahmins of Travancore consider that their manuscripts are likely to have as just a claim to high antiquity, or at least to accurate preservation, as those in the temples in the North; and for the same reason that the Christian and Jewish records have been so well preserved; which is, that the country of Travancore, defended by mountains, has never, according to tradition, been subjugated by invaders from the north of Hindostan.

The design of investigating the history and literature of the Christians and Jews in the East, was submitted to the marquis Wellesley before he left India. His lordship, judging it to be of importance that the actual relation of the Syrian Christians to our own church should be ascertained, and auguring something interesting to the republic of letters from the investigation of the Syriac and Jewish antiquities, was pleased to give orders that public aid should be afforded to Dr. Buchanan, in the prosecution of his inquiries, wherever it might be practicable. To the operation of these orders it is owing that the proposed researches, of which some slight notices are given above, have not been made in vain.

Cochin,
January 1807.

XXXV. *On the probable Composition of Sulphur. By a Correspondent.*

THE decomposition of any of those substances, which are at present regarded as simple, would certainly be a considerable

rable step in the advancement of the science of chemistry.—Among the simple combustibles is a substance, which I am induced to think a compound; I mean sulphur. It appears to be compounded of the electric fluid and some atmospherical gas; and this I think may be safely concluded from the following considerations:—

1. Upon briskly exciting the electrical machine, a strong sulphureous odour may be perceived. From whence can this arise, except from the real presence of sulphur, or some incipient process of its formation?

2. In violent thunder-storms also, we frequently perceive a sulphureous smell. This must undoubtedly either arise from the electric fluid itself, or it must proceed from the agency of that fluid on certain surrounding bodies.

3. But sometimes upon such occasions real sulphur has been produced. In America, while a company was in a room together, a violent thunder-storm came on; some of the persons present were even lifted off their feet, and the chamber windows were found covered with real sulphur. Surely no one will affirm that this sulphur was originally in a concrete state in the atmosphere. What could have raised it from the earth? for it does not sublime, as water evaporates, at the usual temperature of the atmosphere. What could have supported it in the air? or Why should it never descend but in a thunder-storm? In short, it is reasonable to suppose that it was formed in the air, and that the electric fluid is one of its component parts.

4. It is a well-known fact that the sulphurets of copper and iron emit light in any gas, or even in a vacuum; this is also a distinguishing property of the electric fluid. And as sulphur and this fluid are the only two substances in nature which shine without the presence of oxygen, must we not suppose that a strong analogy subsists between them; or even that they are the same substance differently modified and combined?

5. It is a circumstance worthy of attention, that Dr. Priestley and other philosophers have strongly suspected the electric fluid of possessing acid properties: in this respect

it coincides with sulphuretted hydrogen, which without the apparent presence of oxygen shows itself to be an acid, by converting vegetable blues into red.

6. The fumes of sulphur will whiten a red rose, and this is also a property of the electric spark.

7. Dr. Priestley among his original experiments observes, that as he was passing the electrical explosion over lead, (I believe, to form those curious circles which he first remarked) he found some sulphur upon the lead. This he attributes to the disengagement of the sulphur contained in the ore. Yet it would be proper to repeat the same experiment with pure lead, and observe if it be possible to procure the same result. —Indeed I am inclined to think, that the black grains mentioned as being produced, when wire is melted by the electric explosion, have been too little examined. Perhaps they may sometimes be sulphurets or sulphuretted oxides of the metal, instead of being pure oxides, as has been generally supposed.

In short, from the facts above stated, I am led to conclude, that sulphur is probably a compound substance, containing the electric fluid as one of its principles, and perhaps also some surrounding atmospherical substance or substances as the other. By passing a strong spark through pure oxygen and other aërial fluids, or by experiments upon sulphur itself with a particular view to this subject, we may hope that its composition will be finally proved.

As in the infancy of chemistry those gases passed unobserved, which the labours of Priestley have since proved to be such general agents; so perhaps in future years, the galvanic, electric, magnetic, and other subtle fluids may be found equally universal in their operations. Perhaps posterity may find the electric fluid to be a component part of all the simple combustibles. Perhaps to its presence oxygen may owe its power of supporting combustion, and its acidifying principle. For as the electric fluid is infinitely more subtle than oxygen, and seems to possess the properties of combustion and acidity without the apparent presence of oxygen; it is more improbable that electricity

electricity should owe these qualities to the gas, than that oxygen should derive them from electricity. Perhaps to this fluid, independent of oxygen, the muriatic acid may owe its acidity; and as the electric fluid has been shown above to possess the quality of removing colour, the muriatic acid may owe the same property, which it possesses, to this very active fluid. Perhaps, in fine, it may have a greater share in the formation of nitric acid than has been generally imagined. But passing by conjectures, which the present generation has little hopes of seeing verified, I shall come to a conclusion, happy if the above hints should conduct some fortunate genius to open so wide a field of interesting and important discovery. I am, sir, yours,

E. B.

XXXVI. *Description of an Improved Galvanic Trough.* By C. Wilkinson, *Esq.*

To Mr. Tilloch.

SIR,

Having experienced considerable inconvenience in the course of my galvanic experiments, with the emptying the troughs, and of correcting any defects as to the plates becoming unsoldered, or the trough leaking; I have removed those difficulties by the following construction upon the principle of Volta's Couronne des Tasses.—The box is formed as usual, but with a series of wooden partitions, in place of the usual plates of metals, about half an inch distant from each other, and well covered with cement; a piece of copper wire bent as Z, C, (fig. 3. Plate V.) with a ring R soldered to it in a direction parallel to the zinc and copper plates: the end Z is soldered to the zinc plate, and the end C to the copper; the ring is for the convenience of passing a wire through, when the experiments are concluded, so that all the plates may be raised at once from the trough. It is evident by this arrangement that we have a power equal to the sum of both the zinc surfaces: allowing for the loss sustained by the common method, from the part

covered with cement, we should have a battery composed of 4-inch plates equal to one composed of 6-inch plates, according to the construction of Cruikshanks. The plates in this arrangement can easily be repaired, and the acid fluid may be left in the trough.

I am, sir,

Yours respectfully,

No. 19,
Soho Square.

C. WILKINSON.

N. B. It will necessarily be understood that the bent wire is to be placed on each partition, and the same order observed as in other galvanic arrangements; that a zinc plate soldered to one bent wire shall be in the same cell with a copper plate soldered to another bent wire, and taking care that these plates are not in contact with each other. This species of galvanic arrangement may be seen at Mr. Eastwick's, 102, Aldersgate-street.

XXXVII. *Additional Memoir upon living and fossil Elephants. By* M. CUVIER.

[Continued from p. 65.]

I HAVE drawn up a table of the numbers and dimensions of these laminæ, which I subjoin. From this we may see,

1st, That the laminæ vary in thickness in various individuals of each species.

2dly, That there is, as we have said a little before, a connection between this thickness and the number of the laminæ; *i. e.* the more laminæ there are in a tooth, the thicker is each lamina taken separately.

3dly, That nevertheless, by comparing together some teeth with the same number of laminæ, these laminæ always occupy a space sensibly less in fossil grinders, and that this difference goes very far in certain specimens; and so much the further, the greater the number of laminæ.

TABLE.

TABLE.

FOSSIL TEETH.	Total number of the laminæ.	Number of the worn laminæ.	Total length.	Length of the lamin worn.	Breadth.
UPPER TEETH.					
From Siberia, brown, laminæ separated, but little altered. Daubenton, No. 1023	XXV	11	0·260	0·135	0·085
Origin unknown, yellowish, little altered	XX	16	0·200	0·165	0.081
From Siberia, brown, blackish, several laminæ wanting before and behind	XVIII	12		0·110	0·080
From Siberia, very much altered in its cement, some laminæ wanting. Daubenton, 1022	XVI	13½	0·185	0·165	0·089
Origin unknown, altered, white, one lamina at least wanting behind	XV	14		0·165	0·075
Origin unknown, very much altered, white, much worn	XV	15	0·165	0·165	0·084
From Toulouse, much altered, white, and much worn	XIII	13	0·095	0·095	0·050
From Fouvent, altered, yellow, and worn	XII	12	0·085	0·035	0·037
From ditto, yellow, much worn	VII	7	0·055	0·055	0·035
LOWER TEETH.					
From the canal of Ourque	XXIV	22	0·245	0·247	0·089
Origin unknown, white, earthy, broken in two places	XXIV	12	0·265	0·142	0·085
From Siberia (probably), brown, but not altered	XXI	11	0·250	0·160	0·070
From Fouvent, yellow, earthy, four fractures behind	XIX	15	0·230	0·190	0·080
Probably from Siberia, little altered, black	XVIII	18	0·178	0·178	0·088
From the environs of Cologne	XVIII	13	0·230	0.180	0·075
A small tooth from the same place	XIV	11	0·125	0·083	0·050
A fossil tooth from Siberia—M. Camper's cabinet	XIII		0·160		
Idem	XI		0·140		
TEETH FROM INDIA.					
UPPER TEETH.					
Of an elephant of Ceylon	X V	11	0·200	0·162	0·055
Of the grand skeleton mookna	XIV	7	0·177	0·102	0·060
Of the dentelah skeleton	XIV	8			
Separate tooth in a cabinet	XIV	7	0·145	0·090	0·045
Separate tooth of a mookna, or female	XIV	5	0·155	0·085	0·055
Another do. from a cabinet	XIV	4	0·120	0·045	0·045
Idem	XIII	8	0·150	0·092	0·060
Idem	XI	10	0·150	0·125	0·065
Front tooth of the dentelah skeleton	IX	9	0·080	0·080	0·057
Ditto of the mookna, from the separate head of the animal	VII	7	0·078	0·078	0·055

(*Table continued.*)

TEETH FROM INDIA.	Total number of the laminæ.	Number of the worn laminæ.	Total length.	Length of the worn laminæ.	Breadth.
Front tooth of the mookna from the entire skeleton - - - -	VII	7	0·075	0·075	0·060
Tooth of a very young elephant—Daubenton, 1019 and 1020 - -	VII	7	0.055	0·055	0·030
LOWER TEETH.					
Tooth from Ceylon—M. Camper's cab.	XXII		0·270		
Separate in the anatomical cabinet, partly sawed - - - - -	XIX		0·315		0·070
Tooth from Ceylon—M. Camper's cabinet - - - - - -	XVII		0·190		
Head of the mookna skeleton -	XV	10	0·230	0·156	0·065
Separate head of the mookna -	XV	8	0·205	0·110	0·055
Separate tooth from M. Faujas's cabinet	XIV	12	0·200	0·158	0·054
Skeleton of the dentelah - -	XIII	12	0·182		0·060
Separate tooth in the anatomical cabinet	XIII	13	0·192	0·192	0·065
Tooth of a separate head of the dentelah of Ceylon - - - -	XII	10	0·240	0·215	0·065

Thus, when M. Camper opposes to my theory the tooth of a living elephant with thin laminæ, and another with thick laminæ, it is because the first he has represented, pl. xix. fig. 2. of his work, has only 12 laminæ, and proceeds from a young elephant; and because the other (*ib.* fig. 6., as well as that in pl. xiii. fig. 4 and 5) has 23, and belongs to an old animal. It is only necessary to compare together some teeth with the same number of laminæ.

It results from this first character, (the narrowness of the laminæ,) that the number of these laminæ, which serve at once for trituration, must have been more considerable in the fossil elephant than in the elephant of India.

Corse says expressly, that this last has scarcely more than ten or twelve in action at once, and we very often find fossil teeth which have their twenty-four teeth worn: such is that from the forest of Bondy, represented in pl. vi. fig. 1.

A second character which does not appear less sensible is, that the lines of enamel which intersect the cuts of the laminæ are thinner and less festooned in fossil teeth than in others. I remark this in all the specimens of our museum, one only excepted, of which I shall speak below.

A third

A third character is taken from the breadth, as well absolute as proportional, of the teeth, being much more considerable in the fossil elephant than in that of India. We may ascertain this by referring to the fifth column of my table. We there see that the fossil elephants have almost all from 0·08 to 0·09 in breadth, and the teeth of the living from 0·06 to 0·07.

If these differences stood alone, perhaps they would not be sufficient to establish a distinction of species; but as they agree with the differences in the jaws and in the crania, as we shall soon see, they become important.

But are there none else in the fossil state but these teeth with narrow laminæ?

I have mentioned a specimen already with broad laminæ: it was dug up near Porentrui, in the department of the Upper Rhine. Without being very much altered, it is sufficiently so to entitle it to the appellation of a true fossil. Nine laminæ remain entire, and an uncertain number have been carried off from behind. These nine laminæ are thick, much undulated, and occupy a space of 0·180 in length: their breadth is still more considerable than in other fossil teeth, being 0·090. This tooth must have belonged to a very old elephant.

M. Adrian Camper speaks of three fragments of fossil teeth, which he has in his cabinet*, the laminæ of which are as broad as those in living elephants; but we must know whether the teeth to which these fragments belonged had numerous or few laminæ, before we can institute a comparison.

M. Authenrieth informs me that he saw at Philadelphia some teeth, which, in his opinion, resembled much more the African than the Asiatic elephant: but Mr. Barton positively assures me that these were fresh teeth brought from Africa. That which was engraved for Mr. Drayton's work upon Carolina, resembles the common fossil teeth; and those of which M. Humboldt brought over some fragments from Mexico also resemble them, as well as those which Mr. Barton speaks of.

* Descr. anat. d'un Eleph. p. 19.

M. Humboldt indeed says, that he found near Santa Fé an immense quantity of fossil elephant bones, *as well African as of the Ohio species*; but a closer examination has since shown, that all these bones were of a particular species of mastodontus.

It seems therefore clear, that beyond comparison the greatest number of fossil elephants' teeth have narrow laminæ, and that the small number of exceptions hitherto discovered are neither very important nor well authenticated.

Article VI.

Varieties in the Size and Curvatures of the Tusks of Elephants—Comparison of fossil Tusks with those of living Elephants.

a. Tusks of the living Species.

Let us now examine the varieties of tusks, and the differences remarked in this respect among elephants.

Their texture exhibits no important differences. It always presents upon its transverse section those streaks which proceed like an arc of a circle from the centre to the circumference, and form, in growing, curvilinear lozenges which occupy the whole disk, and which are more or less broad, and more or less perceptible to the eye. This character, common to all elephant ivory, and depending immediately upon the pores of their pulpy nucleus, is not to be found in the tusks of any other animal. It is to be seen in all fossil tusks, and it refutes the opinion of Leibnitz*, adopted by some other writers, and even by Linnæus†, that the mammoth horns might have belonged to the *trichecus rosmarus*. The tusks of these animals, however, seem wholly composed of small round accumulated grains.

The size of tusks varies according to the species, sexes, and varieties; and as they are growing all their lives, age more than any thing else influences their dimensions.

The African elephant, as far as we are able to ascertain, has very large tusks in both sexes. The African female, seventeen years old, the skeleton of which is in our posses-

* Protogæa, § xxxiv. p. 26.

† Syst. Nat. ed. xii. p. 49.

sion,

sion, has larger tusks than any male or female Indian elephant of the same size, that we are acquainted with.

It is from Africa we receive the most ivory, and the greatest number of tusks, and they are also harder and whiter than any others.

But our limited knowledge is confined to the elephants of the Western coasts, and to those of the South of Africa: we are ignorant if those of the Eastern shores resemble them in every thing, and if there be any varieties in the interior.

We know from Pennant, however, that the coast of Mozambique furnishes tusks ten feet long, being the largest ever known.

In the Indian species there are more varieties, which Mr. Corse develops with more care than any other writer*.

In the first place, no female of this species has long tusks: they have them small, and directed in a straight line downwards, (this was very properly mentioned by Aristotle† in a passage since improperly contradicted,) and some of them are so short that they cannot be seen until the lips are lifted up.

Further, there are several males which have not large tusks. Tavernier says, that in the island of Ceylon it is only the first born of each female which has tusks‡. On the continent of India they distinguish the *dauntelah*, or elephants with long tusks; the *mookna*, which have very short ones. The latter have them always straight. Wolfs, who travelled much in Ceylon, says, also, that there are several males in that island without tusks, and that they are named *majanis*§.

Among the *dauntelah* they again distinguish, according to Corse, the *pullung dauntelah*, the tusks of which are directed almost horizontally; and the *puttel dauntelah*, in which they are directed straight downwards. Between these two extremes there are several intermediate, and they have also given names to individuals in which one tusk differs from the other, or which have only one. But all these va-

* Phil. Trans. 1799, p. 205 & seq. † Hist. Anim. lib. ii. c. 5.

‡ Tavernier, tome ii. p. 175.

§ Voyage à Ceylan, en Allem. p. 106, cité par Camper, Anat. d'un Eleph. p. 17.

rieties

rieties have nothing constant, and are mixed indiscriminately with each other. We find them together in the same herds.

In Bengal the tusks weigh little more than seventy-two pounds, and they do not exceed fifty in the province of Tipperah, which produces the best elephants. There are tusks in London, however, probably from Pegu, which weigh 150 pounds. It is in fact from Pegu, and from Cochin-China, that the largest elephants and tusks of the Indian species come. The coast of Malabar furnishes no tusks, according to Pennant, more than four feet long.

I have drawn up the following table of the length, diameter, and weight of the largest tusks, taken from other authors, or actually inspected by myself.

The tusks from Africa are not distinguished here from those of India, and there is not all the accuracy we could wish in the kinds of measures employed.

TABLE.

Authors who have quoted the facts.	Their authorities and details upon the origin of the tusks.	Length following the curvature.	Diameter at the thick end.	Weight.
				lbs.
Hartenfels, Elephantographia, p. 47 & 48.	Tusk from Sumatra, according to Louis Vartoman, quoted by Jonston	—	—	168
	Tusk mentioned by J. C. Scaliger, "De Reb. Ind." - - -	—	—	162
	Tusk from the cabinet of Septal, quoted by Herzog - - -	—	—	160
	Tusk mentioned by Vielhauer, in his "Traité des drogues etrangéres"	—	—	200
	Tusk by Louis Barth,—"Rer. Indic."	—	—	325
	Tusk, at Basle, brought from India, quoted by Munster in his "Cosmographie" - - - - -	9′	—	about 100
	Idem - - - - - -	—	—	114
	Another tusk mentioned by J. C. Scaliger	more than 5′	—	—
	Idem by Al. Cadamosto - -	8′	—	—
	The largest tusks, according to Gyllius	10′	—	—
	A tusk in the possession of a merchant of Venice - - - - -	14′	—	—
	The tusks taken from Firmus, by Aurelian, according to Flavius Vopiscus	10′ Rom.	—	—
Camper, Descr. Anat. d'un Eleph.	Common tusks from Guinea -	—	—	100 to 120
	A tusk belonging to M. Wolfers, merchant in Amsterdam	7′ 4″ of France.	9″ 1/3	208

Tusk

(*Table continued.*)

Authors who have quoted the facts.	Their authorities and details upon the origin of the tusks.	Length following the curvature.	Diameter at the thick end.	Weight.
Camper, Descr. An. d'un Eleph. p. 243.	Tusk belonging to M. Ryfsnyder, merchant in Rotterdam, according to Klockner	—	—	lbs. oz. 250
	Tusk sold at Amsterdam, same author	—	—	350
	Tusk in Camper's cabinet	6″	7″	105
Faujas, Géologie, 243.	The largest tusk in the Museum of Natural History at Paris	6′ 6″	5″ 4‴	72 8
Fortis, Mem. pour l'Hist. Nat. de l'Ital. 11.	Tusk in the Florence cabinet	—	7″ 6‴	—
Pennant.	The large tusks from Mozambique	10′ Eng. or 9′ 2″ of France	—	—
Buffon, Hist. Nat. tom. xi. in 4to.	Several tusks measured by Eden	9′ Eng.	—	from 90 to 125
	Lopés	—	—	200
	Drack	—	—	200
	Tusks from Lowango, according to the Voyage of the Indian company	—	—	126
	Tusks from the Cape, according to Kolben	—	—	from 60 to 120

As the tusks grow during the life of the animal, and the body does not, the size of an elephant cannot be concluded from its tusks, even by establishing the proportion between individuals of one same variety and the same sex: as, on the other hand, the tusks rot, or break at their points, according to the greater or less use the animal makes of them; and they are sharpened more or less abruptly into a point, we cannot conclude their length from the diameter at their base.

Finally, their weight cannot be concluded from their dimensions, (Messerschmidt in the Philosophical Transactions,) because their cavity at the base may be more or less filled.

The degree of curvature of the tusks of elephants varies almost as much as their size. We have seen above the most common differences in this respect among the Indian elephants. In various cabinets there are several tusks to be seen

seen with curvatures more or less strange, and in particular some are spiral. Camper saw several of them in the British Museum*, and Grew represents one† which is turned round several times; and I know from M. Fabroni, that there is one of this description in the Florence cabinet also. They are frequently seen in the form of the Italic *S*, &c.

b. Fossil Tusks.

It is impossible to ascertain if there have been among fossil elephants the same differences as among those of India, with respect to the tusks of the different sexes, and different varieties, since fossil tusks are generally found separate, and a sufficient number of heads has never been found to entitle us to say if there were ever any adults without long tusks. We are equally little enabled to ascertain the limits of fossil tusks in point of smallness. The small-sized tusks have been little sought after, having excited less attention amongst the workmen.

We are perfectly well acquainted, however, with their limits in point of size: the large ones have never been neglected, and those who have described them have never been tempted to diminish their volume.

I have drawn up a table of the largest fossil tusks, the dimensions of which have been given. From this we may see that they do not much surpass those of living elephants, at least of the African species.

It may be further remarked, that if elephants were allowed to live their natural age in forests, without being hunted, their tusks, growing during their whole life, would acquire a size much more considerable than they generally have.

* Descrip. Anat. d'un Eleph. † Mus. Soc. Reg. pl. iv.

TABLE.

TABLE.

Authors consulted.	Details upon the tusks.	Length following the large curvature.	Diameter at the thick end.	Weight.
				lbs. oz.
Daubenton, tome xi.	No. DCDXCVI of Siberia, truncated in front	length of the trunk 5′ 4″	6″ and at the other end 5″ 4‴	89 4
	No. DCDXCV of Siberia, truncated at both ends	5′	4″ 8‴ & at the other end 4″	4 15
	No. DCDXCIV of Siberia, truncated at both ends	3′ 4″	2″ 10‴ at the two ends	15 5
	No. DCDVCII, truncated at both ends	3′ 3″	2″ 5‴ and 1″ 10‴ at the other end	9 12
Faujas, Géologie, 293.	Tusk from the environs of Rome, found by Messrs. Larochefoncauld and Desmarets, much truncated at the two ends, and broken in three pieces - -	5′	8″	—
Fortis, ii.	Tusk found at Serbaro, near Verona, by Fortis and Count Gazola, truncated at both ends, swelled by infiltration	7′ 6″ of Verona	from 9″ to 10″ ditto.	—
	Fossil tusk from Tuscany -	8′ 6″	—	—
Camper.	Tusk from Siberia—Camper's cabinet	5′ and upwards.	—	—
Zach,	First elephant of Burgtonna	8′ and upwards.	—	—
	Second - - - - -	10′	—	—
Pallas, Nov. Com. Petr xiii. p. 478.	The largest tusk from Siberia, in the Petersburgh cabinet, truncated at both ends	8′	6″ 6‴ & at the other end 6″ 4‴	—
	The largest tusk of Cunstodt, very crooked, truncated at the two ends	5′ 6″	5″ and at the other end 3″	—
	Reisel & Opleiss assert that it was	10′	—	—
Messerschmidt and Breynius, Phil. Trans. xl. p. 134.	A very crooked tusk from Siberia	13′ 6″ 5‴ Roman.	6″	157 1 Apothecaries' weight.
Herman. Prog. pecul.	The tusk suspended in the cathedral, very crooked	6′ 7″	3″ 5‴	—
Idem. Letters.	Tusk at Wendeheine - -	4′ 10″	5″ 6‴	—

As

As to the texture, we have seen a little before, that it is absolutely the same in all the species, and the tusks of the mastodontus are not distinguished in this respect from those of elephants. It only remains therefore to compare their curvature.

Several fossil tusks have only one very common curvature: such are the tusks in our Museum.

But there is a sufficient number of them, the curvature of which is much greater than we see in the tusks of living elephants. The shape approaches a semicircle, or the half of an ellipsis divided by its small axis.

There are four fossil tusks described:—that of Messerschmidt, in the Philosophical Transactions; that in the Strasburg cathedral, according to Herman; that of the church of Halle, in Suabia, according to Hoffman and Beyschag; and that of the cabinet of Stutgardt, according to Authenrieth and Sæger. This striking resemblance of four of the most entire fossil tusks we know, in a point which distinguishes them from the tusks of living elephants, is worthy of remark.

Some have thought of making a distinct character from this circumstance: but it may be easily inferred, that this great curvature depends only upon the length of the tusks, where this circumstance has been remarked.

The part of the tusks once made being no longer subject to change, each increase in length will also be an augmentation in the number of the degrees of the arc it describes.

It is thus that the incisor teeth of hares, when the opposite ones are broken, curl up into a spiral direction.

It is proper, however, to observe, that a tusk from Africa, in our Museum, although six feet long, is by no means so crooked as the four we have quoted.—There are also some fossil teeth turned like a still-worm, as we see in living elephants. Pallas quotes one from the Petersburgh cabinet*. There is one also, but less twisted, in the Stockholm cabinet, of which M. Quensel sent me a drawing.

Thus tusks can establish no certain character, either among the living species, or between the latter and the fossil species.

* Nov. Com. xiii.

[To be continued.]

XXXVIII. *Me-*

XXXVIII. *Memoirs of the late* Erasmus Darwin, *M. D.*

[Continued from p. 141.]

HIS NOSOLOGY.

CLASSES OF DISEASES.

I. DISEASES OF IRRITATION.
II. DISEASES OF SENSATION.
III. DISEASES OF VOLITION.
IV. DISEASES OF ASSOCIATION.

The Orders and Genera of the First Class of Diseases.

CLASS I.

DISEASES OF IRRITATION.

ORDO I.

Increased Irritation.

GENERA.

1. With increased actions of the sanguiferous system.
2. With increased actions of the secerning system.
3. With increased actions of the absorbent system.
4. With increased actions of other cavities and membranes.
5. With increased actions of the organs of sense.

ORDO II.

Decreased Irritation.

GENERA.

1. With decreased actions of the sanguiferous system.
2. With decreased actions of the secerning system.
3. With decreased actions of the absorbent system.
4. With decreased actions of other cavities and membranes.
5. With decreased actions of the organs of sense.

ORDO III.

Retrograde Irritative Motions.

GENERA.

1. Of the alimentary canal.
2. Of the absorbent system.
3. Of the sanguiferous system.

Orders,

Orders, Genera, and Species, of the First Class of Diseases

CLASS I.

DISEASES OF IRRITATION.

ORDO I.

Increased Irritation.

GENUS I.

With increased Actions of the Sanguiferous System.

SPECIES.

1. *Febris irritativa.*	Irritative fever.
2. *Ebrietas.*	Drunkenness.
3. *Hæmorrhagia arteriosa.*	Arterial hæmorrhage.
4. *Hæmoptoe arteriosa.*	Spitting of arterial blood.
5. *Hæmorrhagia narium.*	Bleeding from the nose.

GENUS II.

With increased Actions of the Secerning System.

SPECIES.

1. *Calor febrilis.*	Febrile heat.
2. *Rubor febrilis.*	——— redness.
3. *Sudor calidus.*	Warm sweat.
—— *febrilis.*	Sweat in fevers.
—— *a labore.*	—— from exercise.
—— *ab igne.*	—— from fire.
—— *a medicamentis.*	—— from medicines.
4. *Urina uberior colorata.*	Copious coloured urine.
5. *Diarrhœa calida.*	Warm diarrhœa.
——— *febrilis.*	Diarrhœa from fever.
——— *crapulosa.*	——— from indigestion.
——— *infantum.*	——— of infants.
6. *Salivatio calida.*	Warm salivation.
7. *Catarrhus calidus.*	——— catarrh.
8. *Expectoratio calida.*	——— expectoration.
9. *Exsudatio pone aures.*	Discharge behind the ears.
10. *Gonorrhœa calida.*	Warm gonorrhœa.
11. *Fluor albus calidus.*	—— fluor albus.
12. *Hæmorrhois alba.*	White piles.
13. *Serum e vesicatorio.*	Discharge from a blister.
14. *Perspiratio fœtida.*	Fetid perspiration.
15. *Crines novi.*	New hairs.

GENUS

GENUS III.

With increased Actions of the Absorbent System.

SPECIES.

1.	*Lingua arida.*	Dry tongue.
2.	*Fauces aridæ.*	Dry throat.
3.	*Nares aridi.*	Dry nostrils.
4.	*Expectoratio solida.*	Solid expectoration.
5.	*Constipatio alvi.*	Costiveness.
6.	*Cutis arida.*	Dry skin.
7.	*Urina parcior colorata.*	Diminished coloured urine.
8.	*Calculus felleus et icterus.*	Gall-stone and jaundice.
9.	——— *renis.*	Stone of the kidney.
10.	——— *vesicæ.*	Stone of the bladder.
11.	——— *arthriticus.*	Gout-stone.
12.	*Rheumatismus chronicus.*	Chronic rheumatism.
13.	*Cicatrix vulnerum.*	Healing of ulcers.
14.	*Corneæ obfuscatio.*	Scar on the cornea.

GENUS IV.

With increased Actions of other Cavities and Membranes.

SPECIES.

1.	*Nictitatio irritativa.*	Irritative nictitation.
2.	*Deglutitio irritativa.*	Irritative deglutition.
3.	*Respiratio et tussis.*	Respiration and cough.
4.	*Exclusio bilis.*	Exclusion of the bile.
5.	*Dentitio.*	Toothing.
6.	*Priapismus.*	Priapism.
7.	*Distentio mammularum.*	Distention of the nipples.
8.	*Descensus uteri.*	Descent of the uterus.
9.	*Prolapsus ani.*	Descent of the rectum.
10.	*Lumbricus.*	Round worm.
11.	*Tænia.*	Tape-worm.
12.	*Ascarides.*	Thread-worms.
13.	*Dracunculus.*	Guinea-worm.
14.	*Morpiones.*	Crab-lice.
15.	*Pediculi.*	Lice.

GENUS V.

With increased Actions of the Organs of Sense.

SPECIES.

1.	*Visus acrior.*	Acuter sight.

2. *Auditus acrior.*	Acuter hearing.
3. *Olfactus acrior.*	——— smell.
4. *Gustus acrior.*	——— taste.
5. *Tactus acrior.*	——— touch.
6. *Sensus caloris acrior.*	——— sense of heat.
7. ——— *extensionis acrior.*	——— sense of extension.
8. *Titillatio.*	Tickling.
9. *Pruritus.*	Itching.
10. *Dolor urens.*	Smarting.
11. *Consternatio.*	Surprise.

ORDO II.

Decreased Irritation.

GENUS I.

With decreased Actions of the Sanguiferous System.

SPECIES.

1. *Febris inirritativa.*	Inirritative fever.
2. *Paresis inirritativa.*	——————— debility.
3. *Somnus interruptus.*	Interrupted sleep.
4. *Syncope.*	Fainting.
5. *Hæmorrhagia venosa.*	Venous hæmorrhage.
6. *Hæmorrhois cruenta.*	Bleeding piles.
7. *Hæmorrhagia renum.*	——— from the kidneys.
8. ——————— *hepatis.*	——— from the liver.
9. *Hæmoptoe venosa.*	Spitting of venous blood.
10. *Palpitatio cordis.*	Palpitation of the heart.
11. *Menorrhagia.*	Exuberant menstruation.
12. *Dysmenorrhagia.*	Deficient menstruation.
13. *Lochia nimia.*	Too great lochia.
14. *Abortio spontanea.*	Spontaneous abortion.
15. *Scorbutus.*	Scurvy.
16. *Vibices.*	Extravasations of blood.
17. *Petechiæ.*	Purple spots.

GENUS II.

With decreased Actions of the Secerning System.

SPECIES.

1. *Frigus febrile.*	Coldness in fevers.
——— *chronicum.*	——————— permanent.
2. *Pallor fugitivus.*	Paleness fugitive.
——— *permanens.*	——————— permanent.

3. *Pus*

3. *Pus parcius.*	Diminished pus.
4. *Mucus parcior.*	Diminished mucus.
5. *Urina parcior pallida.*	Pale diminished urine.
6. *Torpor hepaticus.*	Torpor of the liver.
7. *Torpor pancreatis.*	Torpor of the pancreas.
8. *Torpor renis.*	Torpor of the kidney.
9. *Puncta mucosa vultûs.*	Mucous spots on the face.
10. *Maculæ cutis fulvæ.*	Tawny blots on the skin.
11. *Canities.*	Gray hairs.
12. *Callus.*	Callus.
13. *Cataracta.*	Cataract.
14. *Innutritio ossium.*	Innutrition of the bones.
15. *Rachitis.*	Rickets.
16. *Spinæ distortio.*	Distortion of the spine.
17. *Claudicatio coxaria.*	Lameness of the hip.
18. *Spina protuberans.*	Protuberant spine.
19. *Spina bifida.*	Divided spine.
20. *Defectus palati.*	Defect of the palate.

GENUS III.

With decreased Actions of the Absorbent System.

SPECIES.

1. *Mucus faucium frigidus.*	Cold mucus from the throat.
2. *Sudor frigidus.*	—— sweat.
3. *Catarrhus frigidus.*	—— catarrh.
4. *Expectoratio frigida.*	—— expectoration.
5. *Urina uberior pallida.*	Copious pale urine.
6. *Diarrhœa frigida.*	Cold diarrhœa.
7. *Fluor albus frigidus.*	—— fluor albus.
8. *Gonorrhœa frigida.*	—— gonorrhœa.
9. *Hepatis tumor.*	Swelling of the liver.
10. *Chlorosis.*	Green sickness.
11. *Hydrocele.*	Dropsy of the vagina testis.
12. *Hydrocephalus internus.*	——— of the brain.
13. *Ascites.*	——— of the belly.
14. *Hydrothorax.*	——— of the chest.
15. *Hydrops ovarii.*	——— of the ovary.
16. *Anasarca pulmonum.*	——— of the lungs.
17. *Obesitas.*	Corpulency.

18. *Splenis tumor.*	Swelling of the spleen.
19. *Genu tumor albus.*	White swelling of the knee.
20. *Bronchocele.*	Swelled throat.
21. *Scrophula.*	King's evil.
22. *Scirrhus.*	Scirrhus.
23. ——— *recti.*	——— of the rectum.
24. ——— *urethræ.*	——— of the urethra.
25. ——— *œsophagi.*	——— of the throat.
26. *Lacteorum inirritabilitas.*	Inirritability of the lacteals.
27. *Lymphaticorum inirritabilitas.*	Inirritability of the lymphatics.

GENUS IV.

With decreased Actions of other Cavities and Membranes.

SPECIES.

1. *Sitis calida.*	Thirst warm.
——*frigida.*	——- cold.
2. *Esuries.*	Hunger.
3. *Nausea sicca.*	Dry nausea.
4. *Ægritudo ventriculi.*	Sickness of stomach.
5. *Cardialgia.*	Heart-burn.
6. *Arthritis ventriculi.*	Gout of the stomach.
7. *Colica flatulenta.*	Flatulent colic.
8. *Colica saturnina.*	Colic from lead.
9. *Tympanitis.*	Tympany.
10. *Hypochondriasis.*	Hypochondriacism.
11. *Cephalæa frigida.*	Cold head-ach.
12. *Odontalgia.*	Tooth-ach.
13. *Otalgia.*	Ear-ach.
14. *Pleurodyne chronica.*	Chronical pain of the side.
15. *Sciatica frigida.*	Cold sciatica.
16. *Lumbago frigida.*	—— lumbago.
17. *Hysteralgia frigida.*	—— pain of the uterus.
18. *Proctalgia frigida.*	—— pain of the rectum.
19. *Vesicæ felleæ inirritabilitas et icterus.*	Inirritability of the gall-bladder and jaundice.

GENUS V.

With decreased Actions of the Organs of Sense.

SPECIES.

1. *Stultitia inirritabilis.*	Folly from inirritability.

2. *Visus*

2.	*Visus imminutus.*	Impaired vision.
3.	*Muscæ volitantes.*	Dark moving specks.
4.	*Strabismus.*	Squinting.
5.	*Amaurosis.*	Palsy of the optic nerve.
6.	*Auditus imminutus.*	Impaired hearing.
7.	*Olfactus imminutus.*	——— smell.
8.	*Gustus imminutus.*	——— taste.
9.	*Tactus imminutus.*	——— touch.
10.	*Stupor.*	Stupor.

Ordo III.

Retrograde Irritative Motions.

GENUS I.

Of the Alimentary Canal.

SPECIES.

1.	*Ruminatio.*	Chewing the cud.
2.	*Ructus.*	Eructation.
3.	*Apepsia.*	Indigestion, water-qualm.
4.	*Vomitus.*	Vomiting.
5.	*Cholera.*	Cholera.
6.	*Ileus.*	Iliac passion.
7.	*Globus hystericus.*	Hysteric strangulation.
8.	*Vomendi conamen inane.*	Vain efforts to vomit.
9.	*Borborigmus.*	Gurgling of the bowels.
10.	*Hysteria.*	Hysteric disease.
11.	*Hydrophobia.*	Dread of water.

GENUS II.

Of the Absorbent System.

SPECIES.

1.	*Catarrhus lymphaticus.*	Lymphatic catarrh.
2.	*Salivatio lymphatica.*	Lymphatic salivation.
3.	*Nausea humida.*	Moist nausea.
4.	*Diarrhœa lymphatica.*	Lymphatic flux.
5.	*Diarrhœa chylifera.*	Flux of chyle.
6.	*Diabetes.*	Diabetes.
7.	*Sudor lymphaticus.*	Lymphatic sweat.
8.	*Sudor asthmaticus.*	Asthmatic sweat.
9.	*Translatio puris.*	Translation of matter.
10.	——— *lactis.*	——— of milk.
11.	——— *urinæ.*	——— of urine.

GENUS III.

Of the Sanguiferous System.

SPECIES.

1. *Capillarium motus retrogressus.*	Retrograde motion of the capillaries.
2. *Palpitatio cordis.*	Palpitation of the heart.
3. *Anhelatio spasmodica.*	Spasmodic panting.

[To be continued.]

XXXIX. *Life of the* DUKE *de* CHAULNES.

MICHAEL FERDINAND D'ALBERT D'AILLY, duke de Chaulnes, peer of France, lieutenant-general of the king's armies, his majesty's governor and lieutenant-general of the province of Picardy, and reconquered countries, Artois, &c., was born at Paris in 1714. We shall here only consider the duke de Chaulnes as a man of science, and relatively to the arts which he cultivated with so much success; taking our principal traits from the very elegant life of this nobleman, given by M. de Fouchy, one of the most celebrated members of the Academy of Sciences.

After a long series of military services, which obtained him the most distinguished honours from a just and beneficent sovereign, the duke de Chaulnes retired, and dedicated the whole of his leisure to the cultivation of the arts and sciences, for which his mind was eminently qualified by peculiar talents. He procured a very large collection of scientific books, of instruments for making experiments in natural philosophy and mechanics; he arranged a most extensive cabinet of the subjects of natural history; and he built himself a laboratory to enlarge this collection by a number of his own inventions, which were daily produced by his fertile mind. He applied himself with great assiduity to dioptrics, and the improvement of mathematical instruments, especially those which belong more particularly to astronomy.

In 1755 he published a Memoir, which contains experiments relative to an article in the beginning of the fourth book of Newton's Optics.

The great English philosopher had remarked, that in a dark

dark room, if we receive a ray of light from the sun in the axis of a glass, concave on one side, convex on the other, and silvered on the convex side, this ray would necessarily be reflected on itself; but that if we opposed to the reflected ray a white paper or pasteboard pierced in the middle to let the direct ray pass through, the opening in the paper would be circumscribed by four or five coloured rings. The duke de Chaulnes, in repeating this experiment, found, by a most fortunate chance, that when we dull the fore surface of the glass by breathing on it from above, the rings, so far from losing their distinctness, become more brilliant than before. Nothing further was necessary to raise his curiosity. He first thought to render this effect permanent, by substituting for the breath some water mixed with a little milk to dull the glass; and he varied the experiment in so many different ways, that at last he discovered the cause of this singular phænomenon to proceed from inflection; that is, from the property which rays of light have of bending at the approach of solid bodies. He found that the breath and the water mixed with milk formed a kind of round net work, which produced the appearance of coloured rings; that, by substituting for this kind of covering a clear muslin, there are obtained, instead of rings, coloured squares or chequers: and that parallel threads give bands or belts. In short, he made such good use of this happy chance, that Newton's experiment became in his hands an object altogether new, and far more interesting than it had hitherto been.

Whilst the duke de Chaulnes was amusing himself with his dioptric experiments and improvements, he applied himself to another object equally important: this was the perfecting of astronomical instruments, or, to propose the problem in its fullest extent, the art of producing from instruments of a very small radius, an equal degree of accuracy at least with that obtained from those of a considerable radius, such as were then commonly used. This problem, on account of its difficulty, might till then have been ranked with those of the trisection of an angle, and the quadrature of the circle; but experience has proved to us that he was fully competent to resolve it.

The duke de Chaulnes, in 1755, gave the world a memoir which contained the principles of this discovery. He first thought to apply the motion of an endless screw, to obtain these minute divisions. The screw made of steel would itself mark the widths of the worm on the edge of the limb to be divided; and these marks, which ought to be perfectly equal, he thought might be regulated by means of an *index*; and hence the smallest parts would become accurately obtained by means of very fine and truly equal subdivisions.

Who would not conceive, with him, but that a division made in this manner was exact? Could we suppose there would be any inequalities in a small number of steps of such a screw made with care, and in those of the same species of screw all marked with the same worm? The duke de Chaulnes, nevertheless, found by experience that no confidence whatever is to be placed in this method: the unequal hardness and expansion of the particles of steel in the screw, and of the brass in the instrument, renders the steps of the one unequal to those of the other. Whence it follows that this method of dividing instruments cannot be depended on, and that we must determine by observation the value of each part of a micrometer, and not content ourselves by measuring the whole, or a large portion of its course, depending for the intermediate divisions on the equality of the worm of the screw, as is commonly done. This is a new source of error, for the discovery of which we are indebted to the duke de Chaulnes, and which may alter the most important and best made observations.

It now became necessary to try other methods. The duke de Chaulnes had found for a long time, that *by applying a micrometer to a microscope* he could measure accurately as far as the four thousandth part of a line. It was on this truly ingenious principle, that he, first of any one, undertook to give the division of astronomical instruments a greater degree of accuracy than they were hitherto thought capable of receiving. We cannot here follow him through the whole of his contrivances: all we can say is, that never was any principle applied with more address, and we are astonished,

astonished, in reading this work, at the resources with which his genius furnished him, and the sagacity with which he profited by an infinity of circumstances, that probably would have escaped other persons. The fruit of so much labour and attention was the production of an instrument eleven inches radius furnished with achromatic telescopes, the accuracy of which was so great, that, when compared with two excellent quadrants of six feet radius in measuring solstitial meridian altitudes of the Sun and Arcturus, the same precision was obtained as with them. This trial was the strongest and most certain proof of its excellence to which it could have been submitted.

Not only did he give his instrument the degree of accuracy which we have just spoken of, but he also contrived means of rendering all others equally as exact that might hereafter be made, by a large platform, which he proposed to construct on this principle, and which was, if we may use the expression, to serve in future instead of an able artist. We leave men of science to judge whether the duke de Chaulnes has not completely resolved this difficult problem, and likewise to appreciate the degree of gratitude due to him for this discovery, so valuable to all the mathematical and astronomical world. This entirely new art, the principles of which he had given, as before observed, in 1765, have since been published in greater detail in 1768, in the description of the arts published by the academy.

Every thing that the duke de Chaulnes did with regard to the construction of astronomical instruments, proved to him the great utility of achromatic telescopes. This was a sufficient inducement for him to endeavour to improve them, and he gave the public a Memoir, in which he details his ideas on the subject.

We are astonished, in reading this work, at the inventive powers of his genius, in contriving methods for determining quantities, which, to superficial observers, appear not worthy of notice. The same microscopes which before served for dividing his instruments are here again found useful, but employed in a very different manner, and mounted

mounted on a kind of micrometers, which measure the motion of the instrument to the four hundredth part of a line. It was by the help of these microscopes and several other ingenious instruments, that he measured the exact degree of refrangibility of different kinds of glass; the convex and concave curvature of all the pieces of an object glass without separating them from each other. This singular problem appears at first sight impossible to resolve, or to determine even with any degree of precision when the curvature of the glass which is to correct the aberration of refrangibility, and destroy the colours, is such as it ought to be.

These discoveries were followed by the invention of a new parallactic instrument more firm and convenient than those already in use, by several reflections on the manner of applying the micrometer to these telescopes, and to measure accurately the value of the parts of this instrument. For this purpose he used a wall, which, that it might be seen from a distance, had the singular property of presenting to the observer thick strokes, by means of which he could measure very small intervals. This Memoir shines throughout with the genius of the inventor, and cannot be read without admiring his contrivances to avoid difficulties, which at the first glance appear insurmountable. Unfortunately this was his last work, and it makes us greatly regret that others which he proposed to execute on this subject, were prevented from being finished by his death.

The duke de Chaulnes's disposition was of the most amiable kind: the mildness from which it proceeded was ornamented by the greatest politeness, and he could scarcely reckon any but friends among all those with whom he lived. The king himself was well acquainted with his zeal and his merit, and often showed him the strongest marks of that kindness which gives pleasure to a good subject and happiness to a gentleman of the court. From his elevated situation one would suppose he was out of the reach of chagrin and reverses, but he experienced some of the most unpleasant ones for a considerable time. He however opposed to them the constancy prescribed by philosophy, and the patience

tience inspired by religion. But it is impossible to contend long with impunity against such enemies to health, and his constitution, although strong, at last gave way.

He died the 23d of September, 1769, in less than five hours, of a death that perhaps may be called sudden, but which was certainly not unforeseen, as he put his worldly affairs in order some days before, and received the sacrament with those unfeigned sentiments of religion and piety which had always been the rule of his conduct.

XL. *Report of Surgical Cases in the City and Finsbury Dispensaries in July* 1807, *containing a remarkable Case of Cancer in the Breast. By* JOHN TAUNTON, *Esq.*

FOR the month of July there were admitted on the books of the City and Finsbury Dispensaries 209 surgical patients.

Cured or relieved - -	169
Died - - - -	3
Under cure - - -	37
	209

Mrs. R. æt. 49, first applied for surgical assistance on the 30th of July 1806, for a disease in her breast, which proved to be a confirmed cancer. About eighteen months preceding the above date she discovered a tumour in the left breast, which was hard, and attended with acute darting pains at irregular intervals, but not such as to prevent her from attending her domestic concerns. The breast, now, was not much enlarged, but ulcerated on the left side near the nipple, the skin was puckered, and adhered firmly to the diseased part of the gland: the discharge was ichorous and profuse, and produced extensive inflammation of the integuments on which it ran: the pain was much increased: the glands in the axilla were enlarged and indurated, and a general debility pervaded the whole system. The disease being too far advanced to admit of its being removed by an operation, the ferri rubigo was given in moderate doses: the ulcer

ulcer was dressed with the ung. sabinæ for some days, then with the ung. arsenicum; neither of which produced the least effect. A small blister was then applied between the ulcer and the axilla, and repeated for fourteen successive days; the pain from which was very trivial, and the darting pain, which had been very severe in the beginning, was nearly subsided, the appetite was much improved, and her health and spirits were greatly recruited.

The old ulcer, and that produced by the blister, were dressed with the ung. sabinæ, and the thin ichorous discharge was now succeeded by well digested purulent matter.

At the beginning of September a small blister was applied from the ulcerated part nearest the axilla, around the upper part of the breast, nearly to the sternum, and repeated for many days, so as to form an ulcerated surface about an inch wide. That part of this new ulcer between the breast and the axilla was dressed with the ung. arsen. cum pulv. opii, the upper part with the ung. sabinæ. The sloughs occasioned by the caustic were trivial, and the pain inconsiderable, but a free discharge of purulent matter continued from every part of the ulcer.

On the 8th of September she caught cold, and had a troublesome cough with pain in the chest, which was relieved much by taking a few doses of the lac ammon. cum tinct. scillæ.

The caustic dressing was applied about every other day, sometimes to one and sometimes to another part of the ulcer, and the whole covered with the ung. sabinæ. This was attended with very little pain, and the health of the patient was much improved. The scirrhous tumour appeared to enlarge at the upper part till about the middle of October, when it became stationary, and was greatly diminished in size by the beginning of November.

The ulcer was now dressed with the ung. sabinæ alone. The discharge was good, and the breast entirely free from pain. Some alterative powders, composed of hydrarg. cum sulph. with nitre, were given, and one of the following pills was ordered to be taken every night.

R. Hydrarg.

℞. Hydrarg. Mur. Mit. P. L. Sulph. Aur. Antim. āā ℈i. F. Pil. XL.

This treatment was continued, with very little variation, till February 1807, with evident advantage, the health being completely reinstated: no pain was experienced in the diseased part, which was greatly reduced in size, so as to be much smaller than the other breast.

The ferri rubigo was again given for some weeks, then the above powders, and occasionally the pill at night, the ulcer being dressed with the ung. sabinæ the whole time. With this mode of treatment every thing appeared in the most favourable light, till the beginning of September, when the breast was nearly reduced to a plain surface, and the ulcer was exceedingly small, without the least pain having been experienced therein for many months: the discharge was much reduced in quantity, and continued well digested purulent matter.

She had now a troublesome cough, with pains apparently rheumatic in her limbs; these did not yield to the usual remedies, and she lost strength fast, so that in the beginning of October she was nearly confined to her room.

October the 17th, on removing her from the bed to the chair, the left thigh bone gave way, without any fall or violence, and the left arm became bent above the elbow, producing exactly the appearance represented in the Philosophical Transactions in the case of Elizabeth Quenot of Paris, who died of mollities ossium. In this state she did not experience much pain, when lying still, either from the thigh or arm, but the least motion increased her sufferings exceedingly. The breast remained perfectly easy, and the discharge continued as before. The left arm now became œdematous, her appetite declined, and she died extremely reduced on the fourth of November 1807.

JOHN TAUNTON,
Surgeon to the City and Finsbury Dispensaries, Lecturer on Anatomy, Surgery, Physiology, &c.

Greville-street, Hatton-garden,
December 24, 1807.

ERRATUM.—In the last Report, p. 170, line 12 from bottom, instead of "or round" read "around."

XLI. *Notices respecting New Books.*

Philosophical Transactions of the Royal Society of London, for the Year 1807. Part II.

This Part contains the following papers:—VII. On Fairy-rings. By William Hyde Wollaston, M. D. Sec. R. S.—VIII. Observations on the Structure of the Stomachs of different Animals, with a View to elucidate the Process of converting animal and vegetable Substances into Chyle. By Everard Home, Esq. F.R.S.—IX. Experiments for investigating the Cause of the coloured concentric Rings, discovered by Sir Isaac Newton, between two Object-glasses laid one upon another. By William Herschel, LL. D. F. R. S.—X. On the Economy of Bees. In a Letter from Thomas Andrew Knight, Esq. F. R. S. to the Right Honourable Sir Joseph Banks, Bart. K. B. P. R. S.—XI. Observations and Measurements of the Planet Vesta. By John Jerome Schroeter, F. R. S.—XII. A new Eudiometer, accompanied with Experiments, elucidating its Application. By William Hasledine Pepys, Esq. communicated by Charles Hatchett, Esq. F. R. S.—XIII. Observations on the Nature of the new celestial Body discovered by Dr. Olbers, and of the Comet which was expected to appear last January in its Return from the Sun. By William Herschel, LL. D. F. R. S.—XIV. On the Quantity of Carbon in carbonic Acid, and on the Nature of the Diamond. By William Allen, Esq. F. L. S. and William Hasledine Pepys, Esq. Communicated by Humphry Davy, Esq. Sec. R. S.—XV. An Account of the Relistian Tin Mine. By Mr. Joseph Carne, in a Letter to Davies Giddy, Esq. M. P. F. R. S.—XVI. An Analysis of the Waters of the Dead Sea and the River Jordan. By Alexander Marcet, M. D. one of the Physicians to Guy's Hospital. Communicated by Smithson Tennant, Esq. F. R. S.—Presents received by the Royal Society from November 1806 to June 1807.—Index.

An

An Elementary Treatise on Natural Philosophy. Translated from the French of M. R. J. Hauy, *Professor of Mineralogy at the Museum of Natural History, &c. By* Olinthus Gregory, *A. M. of the Royal Military Academy, Woolwich.* 2 Vols. 8vo. with Plates.

"The design of M. Haüy," as the translator observes, "in composing this work, was not to produce a compilation of earlier performances, a collection of insulated dissertations, in which every former theory shall be exhibited, but none examined; it was rather to give a cast of unity to this department of human knowledge, to present Natural Philosophy though in an abridged, yet in a complete form, to free it from a great number of superfluities with which it had been overcharged, and to develop scarcely any but theories now solidly established, though perhaps previously contested, that he might be the better able to place Physics in the situation it ought to occupy, by assigning their due portions to the comparatively recent branches of Magnetism, Electricity, Galvanism, Crystallography, &c., and by enlarging those boundaries which some modern authors seem to have established upon too narrow a space."

The object which Mr. Gregory had in view in the Translation, was, by giving this work in the same form as his own treatises on Astronomy and Mechanics, to complete a course of Natural Philosophy. He has not, however, confined himself to a bare translation, but has given many valuable notes, which add considerably to the usefulness of the work.

Mr. Gregory has done justice to the author in his translation, and has, we think, rendered a service to the public, by giving, in an English dress, a work written professedly for the use of the French National Lyceum, in conjunction with Biot's Elementary Treatise on Physical Astronomy, and Francœur's Elements of Mechanics.

The work seems to be well adapted for the purpose it was intended to answer, and has less irrelevant verbiage than is generally to be met with in French works on Physics. It is not, however, entirely free from this fault: the following exordium,

ordium, with which the author introduces his remarks "on the Air," may serve as an example:

"After having elucidated the properties of the liquid which bathes the surface of our globe, or glides along within it, we shall proceed to those of the invisible fluid which surrounds it to a great height. Here a very lively self-interest is blended with that which the science inspires of itself, to solicit us towards the study of this fluid; in the midst of which we are continually immersed, which acts upon us in so many different ways, and to which we are indebted both for the preservation of life, and for furnishing us with one of its principal delights; since it is to the air that we first commit our thoughts, to be transmitted to others, with the words which are their symbols."

A translator of Mr. Gregory's acknowledged reputation might certainly have taken upon him to retrench such exuberances, without stepping beyond his province. But, as we have already stated, the work in other respects is valuable, and, we doubt not, will be found an useful addition to the elementary works on science already in the hands of the public.

An Essay on the Warming of Mills and other Buildings, by Steam. By ROBERTSON BUCHANAN, *Civil Engineer.*

This short essay, consisting of only twenty-four pages, contains a variety of curious and useful information, arranged under the following heads:

I. The proportionate Size of Boilers and Quantity of Fuel.—II. The Proportion of Steam-pipe required to heat a given Space.—III. The Substance and Colour of Steam-pipes.—IV. The Direction and Arrangement of the Steam-pipes.—V. The Modes of connecting the Steam-pipes;—and concludes with a general abstract of dimensions and proportions of pipes, and important facts relative to a variety of buildings which have been actually heated by steam.

The advantages of cleanliness, convenience, and safety, which this mode of warming buildings possesses, has long made it an object of attention; but it is only of late that it has been brought into practice, so as to be commodious and certain

certain in its effects. It has, however, now arrived at that point; and this Essay contains a collection of the facts which have been ascertained, for the use of those who may wish to put in practice the warming of buildings by steam.

Besides the advantages of this application of steam for ordinary purposes of warming buildings, it is of importance in a national point of view, as it may prevent accidents in all situations where there is much combustible matter, such as in arsenals and dock-yards.

An Essay on Symbols, with a View to suggesting a new System of Gesture-signs for the Deafly-Dumb. By J. M. Weinberger.

This tract is in the German language, and M. Weinberger, as far as we know, is the first of his countrymen who has devoted his attention to the study of that science, by which Messrs. Sicard and L'Epée have rendered their names sacred to every friend of humanity. M. Weinberger's labours, however, deserve a higher title than that of improvements upon the systems of his predecessors. He first sets out with an attempt to simplify the mode of conveying ideas and language between the deafly-dumb. He discusses the most remarkable methods that have been proposed for gesture, language, and emblematical writing, and concludes by giving a hand alphabet of his own invention. This new system greatly excels the finger talk at present adopted, in so far as it requires the use of one hand alone; and the characters are so contrived as to be capable of succeeding each other with great rapidity.

M. Weinberger seems to have been extremely successful in his practice as a teacher of the deafly-dumb in Germany; and in his work he has detailed the results of some public examinations of his pupils, who displayed great proficiency.

XLII. *Proceedings of Learned Societies.*

ROYAL SOCIETY.

Nov. 26. The President in the chair. Continuation of Mr. Home's paper on the Functions of the Spleen. A de-

coction of madder was injected into the stomach, in the same manner as the indigo; but this not answering the purpose, rhubarb was substituted, in consequence of its extreme sensibility to alkali. This experiment succeeded, and the cardiac portion of the stomach, with a ligature on the pylorus, communicated the rhubarb to a kind of plexus in the spleen, and thence to the bladder. The application of alkali to the urine immediately discovered the presence of the rhubarb, but none appeared by the same means in the liver: hence it was inferred, that the spleen assists in secretion, as well as in assimilating the nutriment.

On the 30th of November the Society held their anniversary meeting; when the president delivered with the Copleyan medal, as usual, a very eloquent address to Mr. Home, taking a brief but perspicuous retrospect of the philosophical labours and discoveries in physiology of that gentleman, from the commencement of his professional career, as the relation and successor of the late Mr. J. Hunter in 1785, to the present period. In the course of the learned President's review of the relative importance of this Fellow's numerous communications, he took occasion to contrast the general estimation of the Transactions of the Royal Society of London, which are produced and supported by the voluntary contributions of its individual members, with those of other nations, where they are supported by considerable revenues drawn from the state. This comparison was not a little flattering to the talents and spirit of Englishmen, and to their disinterested love of science.

The Society then proceeded to the choice of the council and officers for the ensuing year; when the following gentlemen were elected of the council:

Of the old council—The Right Honourable Sir Joseph Banks, Bart. K. B.; sir Charles Blagden, knight; Henry Cavendish, esq.; Humphry Davy, esq.; right honourable Charles Greville; William Marsden, esq.; rev. Nevil Maskelyne, D. D.; George earl of Morton; right honourable sir William Scott, knight; Charles Wilkins, esq.; William Hyde Wollaston, M. D.

Of the new council—John duke of Athol; sir James Earl, knight;

knight; John Gillies, LL. D.; James Glenie, esq.; sir Frederick Morton Eden, bart.; lord Henley; Benjamin Hobhouse, esq.; Joseph Jekyll, esq.; Edward Innes, M. D.; John Rennie, esq.; John Sylvester, LL. B.

And the officers were—the Right Honourable Sir Joseph Banks, K.B. President; William Marsden, esq. Treasurer; William Hyde Wollaston, M. D., and Humphry Davy, esq. Secretaries.

Dec. 10. The President in the chair. The minutes of the proceedings of the anniversary, the amount of the receipts and disbursements, and lists of members dead and new ones elected during the last year, were laid before the Society; after which a mathematical paper, by Mr. Woodhouse, on the form of the teeth of wheels, was read. In this paper the author proposed to unite the method of epicycloidal curves, invented by De la Hire, and improved by Camus, with the analytical method proposed by Euler, in order to reduce them to general practice.

Dec. 17. The President in the chair. The Croonian Lecture, by Mr. Carlisle, on the nature and chemical qualities of the muscles, and natural history of muscular motion, was read. Mr. C. began by taking a physiological view of the circulation of the blood, and of the influence of the nerves, so far as they operate on the muscular fibre. He then noticed the existence of an oxide of iron discovered in the red globules of the blood, which he considered as materially influencing the muscular fibre, and the healthful state of the animal œconomy; and proceeded to relate the results of numerous experiments on vegetable and animal substances, in all of which he found an oxide of iron, as in peas, yolks of eggs, bile, urine, &c. The yolks of eggs he discovered to be entirely composed of a fatty oil and an oxide of iron; but his experiments on the nature of the muscular fibre are not yet in a state to be laid before the Society.

Dec. 24. The President in the chair. A paper, by Mr. Smithson, on quadruple and binary compounds, particularly the sulphurets, was read. The author seemed to doubt the propriety of the distinction, or rather the existence, of quadruple compounds, believed that only two substances could

enter as elements in the composition of one body, and contended that in cases of quadruple compounds, a new and very different substance was formed, which had very little relation to the radical or elementary principles of which it was believed to be composed. This opinion he supported by reference to the sulphurets of lead (galena) and of antimony, and to the facts developed by crystallography. In the latter science he took occasion to correct and confirm some remarks of his in the Transactions for 1804, on different crystals, which he acknowledged have not hitherto been found in nature.

In consequence of the Christmas holidays, the Society adjourned till Monday the 14th of January 1808.

SOCIETY OF ANTIQUARIES.

Mr. S. Lysons laid before this Society some curious extracts from the antient records, containing directions to a bailiff for the management of land, and also a recommendation of oxen in preference to horses for agricultural purposes, written in the reign of Edward III.

Mr. R Smirke, in a letter to sir H. C. Englefield, bart. gave an account of his observations on the substances used as colouring in the paintings found in Saint Stephen's. It appeared to Mr. Smirke, that oil had been used as a varnish for these paintings; and as they were executed prior to the supposed period of the discovery of oil painting in 1410, it was inferred that this art may have been of English origin. This is the more probable, since several English words exist, even since the beginning of the 14th century, in which, among the articles of the *materia pictoria*, is enumerated oil for the painting of public edifices. Hence it was extremely probable, that, as oil was used, it was at least combined with some one colour, in this country, nearly a century before the reputed æra of the discovery of oil painting. Of some of the colours in these paintings, which are now completely enclosed from the view by the new improvements, the composition could not be determined.

BRITISH INSTITUTION.

On the 21st of November a meeting of the committee of directors of the British Institution was held at the Gallery in Pall-mall, for the purpose of adjudging the premiums offered for the three best companions to pictures selected from the works of the old masters.—The following was the decision :

To Mr. Pocock, jun. the premium of one hundred pounds for his picture of "Archbishop Becket's Insolent Visit to the Palace of Henry the Second, with the Intention of excommunicating that Monarch." Painted as a companion to Mr. Angerstein's "Theodosius" by Vandyke.—To Mr. James Green the premium of sixty pounds, for his picture of "Gadshill and the Carriers;" from the second act of the first part of Shakespeare's Henry the Fourth. Painted as a companion to Mr. Duncombe's "Candlelight" by Rubens.—To miss Reinagle the premium of forty pounds, for her "Landscape with Banditti." Painted as a companion to lord Grantham's "Mercury and Admetus" by Salvator Rosa.

The stimulus thus afforded not only to those artists who have been so deservedly successful, but also to their less fortunate competitors (among whom are several who have produced works of considerable merit), will doubtlessly be evinced in their future performances. Indeed, we confidently anticipate that the governors of the British Institution, if they pursue the liberal line of conduct that they have hitherto adopted, will ultimately enjoy the satisfaction of bringing the arts to a state more nearly approximating to perfection, than they have ever yet arrived to in this country.

FRENCH NATIONAL INSTITUTE.

[Concluded from page 187.]

Medicine, which is nothing else than the application of the laws of the animal œconomy to the cure of diseases, has lately made one of its most important discoveries, viz. Vaccination. Its preservative properties are at present sufficiently demonstrated; but observations are still wanting, as to the

modifications of which it is susceptible. M. Hallé has communicated to the Institute some very interesting observations upon the irregularities which the vaccine inoculation has undergone at Lucca in the course of 1806.

These differences did not affect the progress, the periods, nor the essential characters of the vaccine eruption.

They were manifested in the form of the pimple, which, by extending and confounding itself with some small pustules round the principal one, lost both its regular form and the umbilical depression, which it presented at the moment of its formation.

In the nature of the crust which succeeds the pustule, the latter had not the brown shining colour of the crust of the common vaccine; it was irregular in its form, like the pimple which had given birth to it, and left in the skin a hollow, which afterwards filled up completely.

Finally, *eruptions of pustules over the whole body* were seen at the moment the areola was formed around the principal button.

These irregularities were epidemical throughout the whole territory of Lucca.

The counter proofs made by small pox-inoculation upon individuals who had exhibited these irregular symptoms of vaccine, demonstrated that their irregularity had in no measure altered the preservative properties of vaccine.

The third branch of natural history, that which treats of minerals, has been recently enriched with a most interesting fact.

M. Vauquelin has discovered the presence of platina in the famous silver mines of Guadalcanal in Estremadura.

This metal had only been found in Peru hitherto, where it is combined with a multiplicity of different substances. In those of Guadalcanal, it is alloyed with silver, copper, antimony, iron, arsenic, lead and sulphur. It sometimes forms a tenth of the mass.

The same chemist has made some very important experiments upon the refining of iron ores.

France, although poor with respect to precious metals, compensates for this deficiency in the quantity of fine iron;

but

but we know equally well how much this metal differs in goodness, according to the mines from which it comes, and the forges in which it is wrought.

M. Vauquelin, in order to discover the causes of these differences, has begun to analyse with great exactitude the minerals and fluxes generally exposed to the furnace, and the scoriæ or other matters which are separated from it.

He found in the scaly iron ores of Burgundy and Franche Comté, besides oxide of iron, silex, alumine, lime, oxidated manganese, phosphoric acid, magnesia and chromic acid. A part of these substances remains in the flux, and they are ever found in the best refined iron, although the greater quantity passes into scoriæ, and those substances which are sublimed in the furnaces.

It is to the remains of chrome, phosphorus, and manganese, that M. Vauquelin attributes the bad qualities of certain kinds of iron which are brittle both when hot or cold; and all the attention of forge-masters should be directed to free their metal from these noxious substances.

Besides these useful remarks, M. Vauquelin has made a very curious one: viz. that this composition, whether in ores or particularly in the sublimate of furnaces, resembles much that of meteoric stones. Nothing but nickel is to be found in the latter. As all those substances which are sublimed do not remain in the flue of the furnace, and some are without doubt elevated into the air, he thinks it not improbable that these substances enter into the composition of meteoric stones: the only difficulty would be, to ascertain how sublimed metals could unite in the atmosphere in such large masses as we find.

This subject of iron ores has been treated in another point of view by Mess. Descostils and Hassenfratz in the Memoir under the title of Spathic Iron. (See Phil. Mag. vol. xxv.) These ores are more or less fusible, and furnish iron of various qualities. M. Descostils thinks that the difficulty of melting some of them is owing to the magnesia which enters into their composition. All the infusible spathic irons he has analysed furnished him with this earth; and having

added a portion of it to some specimens fusible by themselves, he deprived them of this property. From this he explains the effect of the exposure to air and humidity, in order to facilitate the flux of these minerals: this must happen, because there is some sulphuric acid, which dissolves the magnesia, formed by the decomposition of the pyrites. M. Hassenfratz, however, disputes this theory, and asserts that he has seen infusible spathic iron ores, although they contained no magnesia. He thinks that exposure to the air can only destroy the cohesion of the mineral. We shall give an account of the judgment, when it is pronounced, upon this interesting question in metallurgy.

M. Lelievre has described a mineral, which has been also mistaken for a spathic iron, and which was found to contain more than one half of oxide of manganese combined with nearly one third of carbonic acid, and only 00·8 of iron and 00·2 and a half of lime. It is therefore a *carbonated manganese*, a new species in this genus.

The same mineralogist has described a stone, which he discovered in the island Elba. It contains more than half its weight in oxide of iron, and a little oxide of manganese. The rest is formed of silex and lime. Its crystalline nucleus is a prism with a rhomboidal base, colour black and opaque, hardness a little inferior to that of feldspar, and specific gravity four times that of distilled water. M. Lelievre names it *Jenite*, from the battle of Jena, one of the most memorable events of this century.

M. Baraillon, a correspondent of the historical class, having discovered in the trenches, which he caused to be cut in the antient Roman city of Neris, near Montluçon, some antient tin vases, M. Mongez, member of the same class, has had the curiosity to ascertain their degree of purity. It results from the analyses made by M. Anfrye, inspector-general of the mint, that they contain nearly three tenths and a half of lead. We know from the experiments of M. Proust, that a similar alloy presents none of the dangers generally conceived.

We mentioned last year an important application of chemistry

mistry to the arts, which consisted in rendering common alums equal to Roman alum for dyeing, and we have seen that it is only requisite to purify them from a little iron.

To the different methods invented for this purpose, M. Seguin, a correspondent, has added a new one, taken from the difference and the solubility of pure alum and alum charged with iron. He dissolves sixteen parts of common alum in 24 of water, allows it to crystallize, and by this method obtains 14 parts of alum as pure as that of Rome, and almost as pure as that of Liege.

We may apply this process to the first manufacture, and obtain at once an alum a third more in value.

The same chemist has continued his labours upon the analysis of the juices of vegetables.

He has recently treated of those which contain no tannin; all have more or less albumen and bitter principle. The more abundant the albumen is, the stronger is the smell, and the sap is more easily corrupted. Mushrooms, cruciferæ and solaniæ are of this description. M. Seguin gives a view of the proportion of these two principles, in twenty-two natural families of plants, by remarking in several the differences of these proportions in the various parts of the vegetable, and in the same plant taken at different ages. All these saps, treated by the sulphuric acid, or the muriate of tin, acquired the smell of pears or boiled apples, and sometimes of fermented liquor, like cyder and beer.

What renders this description of researches so difficult, is the prodigious quantity of reactions, and various combinations, which enter into elementary substances so few in themselves.

We have had new proofs of this in the memoir of M. Thenard, professor in the college of France upon nitric ether.

We know that the ethers are odoriferous and combustible liquors, which are obtained by treating alcohol with the acids. The best known is the sulphuric ether. We are indebted to the inquiries of Messrs. Fourcroy and Vauquelin for being acquainted with the progress of its formation, and

all

all the combinations formed with it. The theory of the nitric ether was less perfect. What was mistaken for this article in the shops was not even a true ether. The nitric acid is formed, as we know, of azot and oxygen; alcohol, of carbon, hydrogen and oxygen. Thus, there are only four elementary substances in the two liquors, and there are formed, by bringing them together, ten combinations susceptible of being separated: viz. a great deal of water, of oxidated azotic gas, of ether, a little oxidulated azotic gas, nitrous gas, carbonic acid gas, acetic acid, and a substance which is easily charred. One portion of these substances remains in the first vessel, where the mixture takes place; another passes into the receiver by distillation, and there takes the liquid form; a third remains gaseous.

It is this last portion which is almost wholly ether; and in order to obtain it separately, we must pass the gas through a course of flasks submitted to great cold. The ether is separated in the form of a yellowish liquid, which we must, by means of lime, still deprive of the nitrous and acetous acid it contains.

M. Thenard concludes, from his experiments, that in these operations the oxygen of the acid is combined with a great deal of hydrogen, alcohol, and little of its carbon: from this result plenty of water, gaseous oxide of azot, a small quantity of nitrous acid and nitrous gas, and but little free azot; that the other is formed from the union of the two principles of nitric acid with de-hydrogenated and slightly de-carbonised alcohol; and that the residues of carbon, hydrogen, and oxygen, furnish the acetous acid and the charry matter.

It may be easily conceived how difficult it must be thus to seize, in their minutest details, actions so fugitive, and to separate combinations so various, and so easy to be altered, and reciprocally converted into each other. We regret that our limits prevent us from giving an idea of the ingenious and delicate processes resorted to by M. Thenard.

We may remember the theory peculiar to count Rumford, as to the cause of heat, which he attributes to certain vibrations

vibrations of the particles of bodies, and not to a particular substance, or to caloric, as admitted by several chemists. A very strong objection has been made to him; which is, that bodies are heated when they are condensed, as if the condensation pressed out the caloric contained in them, and which, no longer finding any room, manifests its departure by its effects. Thus water and alcohol, when mixed, lose a fortieth part of their volume, and gain several degrees in the thermometer. Pieces of money come out quite hot from the die under which they are stamped.

Count Rumford has answered these objections by experiments which are not less certain, and in which condensation is accompanied with cold. Thus, some solutions of salts in pure water lose both in volume and in heat. We know well, that salts on dissolving often produce cold, and we explain this phænomenon by the necessity of a solid substance absorbing caloric when it becomes liquid: but this explanation does nor appear applicable when a solution already completely effected is simply diluted with a fresh quantity of water.

We know that steam when confined is susceptible of acquiring a heat far superior to that of boiling water; and count Rumford, long ago, invented a speedy and œconomical method of heating liquids, by introducing into them this steam in a state of extreme heat.

He has made an extremely fortunate application of this discovery in the art of soap-making, and has succeeded in boiling this article completely in six hours, while sixty were requisite in the usual way. The kind of percussion which heated steam gives to the mixture of oil and ley, by penetrating into it, and suddenly condensing, contributes, according to count Rumford, to the acceleration of the process.

This learned chemist has also succeeded in adding new perfection to cauldrons destined for heating liquids, by applying to their bottoms several tubes which descend into the flame, and by thus multiplying the surface of the bottom without increasing its diameter. By these means we not only save fuel, but also the cauldron; because the latter, resisting

sisting more the effect of the heated steam, does not require to be so thick*.

Almost the whole of meteorology depends on the variable action of heat upon the atmosphere. It is the air, when variously heated, that produces the winds, by the inequality of its dilatations; and the winds, carrying the vapours into warmer or colder places than those where they were formed, cause their more complete solution, or their precipitation more or less rapid, *i. e.* fine weather or rain.

M. Dupont Nemours, member of the class of history, has presented to the class of sciences some reflections, which have the merit of rendering in some measure sensible, the futility of every attempt to predict these phænomena from the analogy and experience of the past.

The zone, in the different points of which the sun is vertical in the course of the year, is never precisely the same upon the earth for two consecutive years, nor even for an infinity of centuries: in the mean time the precession of the equinoxes, which does not collect them at the same points until after more than 26,000 years, and the variations of the obliquity of the ecliptic, of which the period is still more tardy, contribute to vary this zone: and even supposing that we had one day of observations antient enough,—in order to be applicable, it must have been requisite that the surface of the earth, the seas, and mountains, which are not less essential elements of this phænomenon, had not changed in this whole interval.

M. Dupont admits that electricity contributes also to vary the weather, forming water by the combustion of hydrogen gas. It is true that it seems now clearly ascertained, that this gas does not exist in the region where storms are formed: but M. Dupont supposes that it is brought down from higher regions in tempests, which, by their violence, disturb the natural order of the strata of the atmosphere.

* The application of tubes to boilers does not appear to have been an invention of count Rumford's. Patents were taken out in England for such a construction of boilers several years ago. A patent was likewise taken out some years ago for heating water by passing steam into it. Edit.

XLIII. *In-*

XLIII. *Intelligence and Miscellaneous Articles.*

To Mr. Tilloch.

Manor House, Hayes, Middlesex,
Dec. 27, 1807.

SIR,

THE cloudy state of the weather for some weeks past had made me almost fear that I should no more see the comet; but within this hour I have found it very distinct, 32′ 32″ E. of α Cygni, and 1° 52′ 30″ N. of that star: it is therefore within the circle of perpetual apparition, and never sets. A small cluster nebula was to-night in the field of Blunt's night-glass at the same time. The comet formed nearly the angle of a small equilateral stellar triangle, through whose haze the angular star was nearly as distinct as the other two.

After much attention the comet was visible to the naked eye, forming a straight line with γ and ξ Cygni, and will be readily found in the tail of the Swan, a few evenings hence, between π and ϱ.

Through my seven-feet Newtonian reflector its disc was very conspicuous and defined: but I could not with any attention ascertain its tail. By due labour I think it will be visible a month longer.

As the month is concluding, I write in haste, that your many readers may not be tempted to forgo their search after this curious object.

I am, sir,

Your obedient servant,

W. WALKER.

ANOTHER COMET.

A letter from a gentleman, dated Crantits, Orkney, Oct. 30, says:—"Last night I observed another comet. It was nearly vertical to this place about eight o'clock. The nucleus is fully as large to appearance as the other comet, which is also still visible. This new comet is very large and distinct. It appears to be on its approach to the Sun; will probably be visible for a considerable time; and seems to have moved, since I first saw it last night, about two degrees."

M. Ca-

M. Caselli, an astronomer of Naples, accounts for the extraordinary heat of the past summer, which continued so intense throughout the whole month of September, by ascribing it to the extreme purity of the face of the sun, which this year was turned towards the earth. For nearly two months he observed none of the spots which are commonly perceived in it. Hence M. Caselli concludes, that the sun's rays, having been emitted in greater abundance and with less interruption, produced that violent degree of heat, which, though it scorched the fields, nevertheless increased their fertility.

LECTURES.

Dr. Clutterbuck, one of the Physicians to the General Dispensary, Aldersgate-street, purposes, during the ensuing Spring, to give a Course of Lectures on the Theory and Practice of Physic, including an Outline of Physiology and the Materia Medica.—The introductory Lecture will be given on Friday, January 22, at six o'clock in the evening, and be continued on Mondays, Wednesdays, and Fridays, at the same hour. Further particulars, with a Prospectus, may be had on application at the Dispensary, or at No. 17, St. Paul's Churchyard.

Mr. Taunton's Spring Course of Lectures on Anatomy, Physiology, Pathology, and Surgery, will commence on the 23d of January, at eight o'clock in the evening, at the Theatre of Anatomy, Greville-street, Hatton Garden. The nights of lecturing are Tuesday, Thursday, and Saturday.

In these Lectures it is proposed first to take a comprehensive view of the structure and œconomy of the living body, and then to consider the causes, symptoms, nature, and treatment of surgical diseases, with the mode of performing the different surgical operations.

An ample field for professional instruction will be afforded, by the opportunity which pupils may have of attending the clinical practice of both the City and Finsbury Dispensaries.

LIST OF PATENTS FOR NEW INVENTIONS.

Samuel Roberts, of Sheffield in the county of York, silver-plater, for a toast-tray capable of being contracted or expanded at pleasure. Nov. 28, 1807.

Thomas

Thomas Cobb the younger, of Calthrop House, near Banbury in the county of Oxford, paper-maker, for certain improvements in the art of making paper in separate sheets. Dec. 4.

Joseph Manton, of Davies-street, Berkeley-square, London, gun-maker, for certain improvements in time-keepers. Dec. 5.

John Williams, of Cornhill in the city of London, stationer, for a new mode of covering and enclosing all kinds of carriages. Dec. 9.

Mark Laybourn, of Great Driffield in the county of York, mechanic, and Richard Millbourn, of the same place, gentleman, for an improved roving machine for preparing flax, tow, and wool for spinning. Dec. 9.

Charles Grant Viscount de Vaux, of Elizabeth-street, Hans-square, Chelsea, for a machine which will show the latitude and longitude at sea, serving also for weighing any object, for measuring space, or the course of a ship and time, showing and keeping account upon dials and upon cosmographical columns which are part of such machine, and also showing the lee-way of a ship; part of which machine may also be applied to other useful purposes. Dec. 9.

James Breck, of Newcastle-under-Lyne in the county of Stafford, ironmonger, for a new method of manufacturing iron straps or girdles into various articles, as a substitute for those now composed of hemp. Dec. 16.

George Remington, of Queen-square, Bloomsbury, in the county of Middlesex, cabinet-maker, for certain improvements on tables and couches. Dec. 16.

John Williams, of Cornhill in the city of London, stationer, for a method of preserving the equilibrium, and preventing all kinds of carriages and vehicles from overturning. Dec. 19.

William Juniper, of the parish of Saint Saviour, Southwark, engine-maker, for certain improved rolls for punching of tire, and drawing hoops for the stocks of wheels, and a segment for sweeping and setting the same. Dec. 19.

Samuel Salter, of Watford in the county of Herts, maltster, for an apparatus for the purpose of drying malt, hops, or any kind of grain. Dec. 19.

METEORO-

METEOROLOGICAL TABLE,
BY MR. CAREY, OF THE STRAND,
For December 1807.

Days of the Month.	Thermometer. 8 o'Clock, Morning.	Noon.	11 o'Clock, Night.	Height of the Barom. Inches.	Degrees of Dryness by Leslie's Hygrometer.	Weather.
Nov. 27	29°	34°	28°	29·67	12	Fair
28	27	33	36	·75	10	Foggy
29	40	41	35	·62	7	Cloudy
30	33	35	38	·80	6	Cloudy
Dec. 1	35	37	35	·86	5	Cloudy
2	39	43	42	·75	4	Cloudy
3	32	37	39	·91	10	Fair
4	39	47	41	·82	17	Fair
5	45	47	44	·57	16	Cloudy
6	35	42	33	·47	25	Fair
7	32	35	30	·52	19	Fair
8	22	24	32	·45	0	Snow
9	33	36	33	·90	15	Fair
10	26	30	24	·93	15	Fair
11	33	39	38	·95	0	Cloudy
12	37	41	39	30·17	9	Cloudy
13	40	42	40	·18	16	Fair
14	41	44	36	·15	10	Fair
15	35	37	37	·11	0	Cloudy
16	37	39	36	·06	3	Cloudy
17	36	37	34	·04	0	Cloudy
18	34	37	36	29·99	0	Cloudy
19	36	38	32	30·09	0	Cloudy
20	29	31	30	·20	4	Cloudy
21	29	30	29	·35	0	Cloudy
22	29	36	34	·22	14	Fair
23	33	35	36	·11	0	Cloudy
24	36	40	37	·12	0	Cloudy
25	37	43	46	·01	10	Cloudy
26	46	50	49	29·99	0	Small rain

N. B. The Barometer's height is taken at one o'clock.

XLIV. *Directions for constructing a cheap Bed and elastic Frame, for the easy Conveyance of sick or wounded Persons. Invented, and most humbly presented to his Royal Highness the Commander in Chief, by* PATRICK CRICHTON, *Lieutenant-colonel of the Second Regiment Royal Edinburgh Volunteers.*

Directions for the Construction of the Elastic Frame.

REFERENCES.

THE lower frame AA (Plate VII.) is made of ash or elm, seven feet long, and five feet four inches broad.

BB. Two strong wooden pillars, bound on the sides by two circular pieces of iron, for supporting the elastic frame.

CCC. The elastic frame, made of the best ash, supported by the wooden pillars, and semicircular pieces of iron.

EE. The frame or cott, containing a mattress or pelisse, stuffed with straw.—Two or three hammocks may be suspended, and will answer as well as the cott.

FF. Rings and iron hooks, by which the cott, bed, and mattress are supported.

GGG. Four handles projecting from the under frame, one foot three inches long each, by which the whole may be carried by four men.

HHHH. Four semicircular hoops, over which a cover can be thrown, to protect the patient from the weather.

The under frame and pillars should be made of ash or elm, well seasoned.

The elastic, or upper frame, should be made of ash, remarkably clean and well seasoned, thick in the middle where it is supported, and tapering towards the ends.

The total expense of the whole, including the iron-work, should not exceed four pounds ten shillings.

Directions for using the Bed and Frame.

The lower frame may be fastened by ropes to any cart or waggon, of the same size, or larger than itself.

The sick or wounded person should first be placed in the bed.

The frame should then be placed over the bed, and the ropes at the head of the bed suspended upon the iron hooks.

Then the ropes at the feet should be hooked up.

The frame, containing one or two sick men, can be easily lifted by the four handles by four men, and carried to any distance to a cart or baggage-waggon.

The lower frame is then fixed to the cart by ropes, and the machine is ready to move.

When the sick are taken from the baggage-cart, the whole frame should be lifted at once, and carried to the hospital.

The bed should then be unhooked, first at the feet and then at the head, and the frame taken away.

Upon large English waggons, two or three of these frames may be conveniently placed.

If the carts of any district are too small for the breadth of the frame, it may be made narrower, so as to adapt it to that conveyance.

When the machine, which is delineated in the plate, was first invented, it was solely intended for the use of the army.

To this purpose it has been successfully applied; and is in common application in several of the garrisons of Great Britain, as affording the easiest meansof transporting sick or wounded soldiers, from garrison or quarters, to the hospital.

Since the time of its being adopted by the army, it has likewise been brought into the service of a great many of the public hospitals, not only for the purpose of conveying maimed or bedridden patients from their houses to the wards, but for removing such patients, as were under the necessity of undergoing operations, from the wards to the operation room, and returning them again from the operation room to the wards, without subjecting them to the necessity of being dressed, or even removed from the beds.

Having successfully answered these purposes, it has of late been used, when fixed upon a cart, waggon, or upon the carriage of a postchaise, for removing wounded persons, or such

as

as were afflicted with disease, and who were unable to support the motion of a chaise or coach, from different parts of the country to towns where they might enjoy the benefit of medical advice.

In this manner, the use of it, in Scotland, has become of late very general, and, fortunately, very beneficial to those who have travelled in it ; all of them concurring, that they were insensible of any unpleasant motion during their respective journeys.

To enumerate the instances of its successful application in this manner would fill a small volume ; but a few facts will enable the public to appreciate its value.

A person was brought in it, with a compound fracture in the thigh bone, from the west Highlands to Edinburgh, a distance of 74 miles, in two days.

A gentleman, with an attack of gout both in his hands and feet, was removed from Edinburgh to the north of England, above 140 miles, in three days.

In both these instances, and a great many more, the bed and frame were suspended to the carriage of a postchaise, and, with a servant sitting in front, travelled post.

Some hundreds of examples can be adduced of the removal of patients by its means, when fixed on a cart or waggon, and in many of these the patients were in a state of the most severe bodily distress ard debility.

In all these removals, the patients have borne testimony to their enduring no additional pain or inconvenience from the motion of the machine ; all of them, even in the most severe cases, declaring, that they were alike insensible of bodily fatigue, or of the least increase of pain, from the mode of conveyance.

The royal colleges of physicians and surgeons of this place have bestowed upon it the most unlimited approbation, both by letters addressed to the inventor, and in the publications of several of their members.

In consequence of these proofs of its successful effects, and these encomiums from the learned and respectable bodies who are so well enabled to decide regarding its merits, a number of applications have of late been addressed to the

inventor, soliciting him to describe and delineate the machine, so as it might be introduced into general use in the various quarters of the kingdom.

To save time in complying with these requests, he adopted the method of printing and circulating these plates, accompanied with a description, which will clearly demonstrate, at how very small an expense, and with how very little mechanical art, the elastic frame can be constructed; for, in fact, there is no village in Britain, in which an ordinary smith and carpenter reside, where it may not be easily made.

Under these circumstances, the inventor feels it a duty he owes to his country, and to those suffering bodily distress, to give it all the publicity in his power; with which view, and with the most ardent wishes for its continuing to prove beneficial, in mitigating the distresses of such as may require its aid, this account is submitted to the public.

Gayfield Place,
17th Sept. 1807.

XLV. *Project for the Establishment of Telegraphs on a New Construction. By* Capt. Pasley, *of the Royal Engineers.*

[Concluded from p. 210.]

2d. A Polygrammatic Telegraph for Day Signals.

In the reflections concerning the use of telegraphs in general, into which I was unavoidably led whilst digesting the above proposal, it appeared to me a fundamental principle of the art, to aim as much as possible at celerity and dispatch, which I found were in some measure to be gained by employing a number of words and sentences adapted to the key of the telegraph, according to the method of sections, instead of adhering entirely to the tedious alphabetical mode, which (to the best of my knowledge) is the only one in common use.

Still there remained a defect, in its being impossible to express a variety of significations without making two or three

three signals for each. The only remedy for this at first seemed to be, increasing the number of combinations of the telegraphs already established by adding more bodies, as, for instance, to construct an Admiralty telegraph with seven, eight, or nine bodies instead of six; but this remedy is only partial, because additional bodies would run into confusion before the signal code can be enlarged to a sufficient extent.

On further consideration it therefore occurred to me, that it might be allowable to propose a new diurnal telegraph; and if my preceding observations are granted, I hope it may meet with approbation, being capable of exhibiting seven hundred and seven thousand two hundred and eighty distinct combinations, whereas no former one used in this country has exceeded sixty-three. I now proceed to describe the nature of the telegraph proposed, which, for the sake of distinguishing it from others on a more confined principle, I shall call the Polygrammatic Telegraph.

Nature and Construction.

Four upright posts are erected, each having two arms moveable on a spindle at top, which in their natural position hang down, but can be raised by means of strings to various degrees of extension, so as to appear in positions either vertical, horizontal, or inclined at an angle of 45° with the horizon. The length of the arms may be about six feet from the centre of motion to the ends, or more, in proportion to the distance between the telegraphic stations. The strings will be worked by two men.

The combinations of two arms in the several positions enumerated are twenty-eight, of which a table is given in Plate VIII: eighteen of these are allotted to the alphabetical characters, and ten to the numerical ciphers, so that using the common mode of signal making, every post with its arms might form a complete telegraph, were it not the object of the present proposal to go further. A book is therefore made of words and sentences arranged in regular order, to the extent judged necessary, and let signal 2567 signify, for example, "*The enemy have landed on the south-west coast,*" and let signal 9304 signify, "*A convoy is just arrived*

rived from the West Indies." Then these two pieces of intelligence will be successively communicated by the two signals. Fig. 2, 2.

But this telegraph has another property, I believe entirely new, of expressing words or parts of words not exceeding four letters, by a single signal. For instance, let it be required to communicate the following orders alphabetically: "*Send* 1000 *men to Dover*," or, "*Three regiments will march to Leith:*" the first will be effected by five signals, and the second by seven, as in fig. 3, 3, 3, 3, 3, and 4, 4, 4, 4, 4, 4, 4.

In working this telegraph no signal is required to denote the end of a word, it being sufficient to mark a pause by leaving one of the posts in its quiescent state. And to distinguish between the numerical signals referring to the book or code, and such as are really intended to denote numbers, the unit place of the latter must never, but that of the former must always, be placed on the fourth or right-hand post of the telegraph. Hence this post, when left quiescent between two numbers, will not be considered to denote a pause or break, as it would between two words. Thus, fig. 5 will signify one thousand, whilst fig. 6 will denote the 1000dth word or sentence in the book, and must be referred to there for its signification. Also, in consequence of the last remark, the signals 5th, 6th, 7th, and 8th, the fig. 7, 8, 9, 10, will signify 104, 506, 820 pounds.

Observing this restriction, it will be found that a signal book may be formed, containing 10,999 words and sentences, if thought necessary, each to be expressed by one change on this telegraph, whilst all unforeseen intelligence can be communicated by an improved alphabetical mode, without these two methods interfering in the least with each other; so that I trust it will be allowed, that the object I had in view, namely, increased dispatch in signal making without loss of clearness or precision, is fully obtained.

C. Pasley, Capt. Royal Engineers.

P. S. In

P. S. In describing the principles of the polygrammatic telegraph, I avoided entering into the minutiæ of its mechanical construction; by which, however varied, no fundamental part of the scheme can be affected. A model made by my directions in Malta proved to all who saw it the practicability of the machine; I shall, in explanation, say a few words here, which will perhaps be almost equally satisfactory.

The under part of the posts is solid, but the upper part of them is composed of two side pieces with a space between, within which the arms play. One of the arms is represented in the annexed figure, (fig. 11,) hanging down in its natural position, so as to be entirely hid by the post when the telegraph is at rest. A roller A is fixed to the arm near its head, having an iron ring *a*, *a*, *a*, screwed upon one side of it, and provided with grooves for the strings *b*, *c*, the ends of which are fastened to it in contrary directions. The other ends of these strings are brought down into the signal room, and have seven knobs (1, 2, 3, 4, 5, 6, 7,) fixed upon them, the intervals between which are proportioned to the circumference of the roller, in such a manner that as they are respectively pulled down to the plane D, D, they will raise the arm by moving it on its pivot (which coincides with the centre of the roller) to the seven positions required in signal making. As the arm rises to any of these positions, the corresponding tooth of the ring *a a a* will be griped by one or other of two springs or catches fixed to the side pieces, which will hold it up in its proper position without fatigue to the men employed, till an order is given to prepare for a new signal. Then, by pulling another string, (not expressed in the figure,) the catches are drawn away from the teeth, and the arms being thus released fall down to their natural state. The same string, by a very simple contrivance, presses the arms down after the fourth position, and prevents their vibrating as they fall at the end of every signal. *d d* is a piece that would be invisible at the telegraphic distances, serving to increase the weight of the part B as much as may be judged necessary. It was omitted in the model, as not being an essential part of the machine in any other respect.

It has been already observed that one man is to work two posts; the arms must therefore be so poised, by duly proportioning the weight of the part (B) above, and of the part (C) below the pivot, that he may with ease be able to raise two arms with each hand, the requisite preponderance of the lower part being at the same time preserved.

With regard to the signal houses chosen for this kind of telegraph, I have only to remark, that instead of having the two exterior posts over the roof of the building, which might require it to be larger than necessary, they may be made to stand upon beams projecting from its extremities*.

XLVI. *Proposal for the Establishment of a National Museum. By* J. S. Duncan, *Esq. of Lincoln's Inn.*

[Concluded from p. 205.]

The following outlines of tablets, supposed to be affixed to different parts of an arranged museum, are not offered as a complete plan of a museum arranged with a view to the illustration of natural theology, but are sketched slightly, with the view of merely suggesting the practicability of such mode of exhibition.

I. Varieties of Power.

II. Extent of Power.

A.

1, *Attraction*. Magnets. Electrometers. Cohering Plates, &c. Compass.

2. *Repulsion*. Magnets. Electrometers. Fire-arms, &c.

3. *Impulse*. Ivory Balls. Reaction, &c.

Gravitation appears to be only a particular attraction. Thus, we may say the heavenly bodies are attracted by, or gravitate toward, one another. Some say, all bodies are impelled by external agency in all cases of what is commonly called attraction and repulsion. Of late this has been maintained by Le Sage of Geneva. It is not material to the conclusions of natural theology, whether these be

* For several omissions in the former part of Capt. Pasley's communication, see the end of the present Number of the Phil. Mag.

different

different powers, or different effects of one power, itself controlled and modified by all-pervading Intelligence.——— Crane, Inclined Plane, Lever, Pulley, Screw, &c.

B.

4. *Terrestrial Globe.*
5. *Celestial Sphere.* *Orrery.*

4. About four-fifths of the surface of the globe consist of water. This large proportion of water displays various relations to the sustenance and welfare of animated beings. It supports vast multitudes, whose whole organization, under very different forms, is peculiarly adapted to that element. Some of its inhabitants require salt in addition to the water they inhabit. The well-being of others requires fresh water. The welfare of others requires occasional change from the former to the latter. Some animals to which water is principally necessary require occasional residence in air. Some commonly respiring air, and dwelling on land, seek their principal sustenance and comfort in the water. The organization of these is variously adapted to either element. Fresh water, as drink, is requisite to the maintenance of most land animals. It is highly important, if not essential, to the maintenance of man. Its relations to our comfort are innumerable. It is necessary to vegetation. It contributes to the formation of earthy inanimate solids, perhaps to the solidification of the greater part of the habitable globe.

The earth in its turn prevents the water from putrefying by affording, conjointly with the air, and with the influences of the sun and moon, facility to its continual motion; straining it through crevices and pouring it along declivities. The surface of the earth assists evaporation: its cavities cool and condense vapours.

The relations of earth to the wants and comforts of all living beings are innumerable.

The air which surrounds the globe is requisite to the support of life, and to the well-being of all living creatures. The heat retained by the earth preserves a great portion of the air from being chilled to the destruction of vegetable and

animal life. Evaporation of water gives coolness to a great portion of air, which, from excessive heat, would otherwise lay waste the torrid regions.

Heat, so necessary to the sustenance, and so conducive to the comfort of living beings, contributes incessantly to produce countless modifications of earth, air, and water, and is itself incessantly controlled by their reagencies.

Moderate cold and moderate heat are terms nearly convertible. Where the moderation of either is required, a moderate degree of the other becomes requisite.—See further, Paley, Nat. Theology, chap. xvii. and xxi.

5. *Planetarium.* This machine is intended to represent the relative situations of the sun and the planets, (one of which is the earth,) at different periods of time. The planets are restrained by their relations to the sun in their respective orbits. The sun dispenses light and heat to all. We may refer, by analogy, to other planets, the advantages which we fully experience from our relations to the sun. The revolutions of the earth round its axis cause the vicissitudes of day and night. But the darkness, the coolness, the tranquil repose of night, are no less requisite to the well-being of man and other animals, than the cheering influences of the day. The earth's orbit, or path round the sun, has such relation or inclination to the equator, and the axis of the earth is placed in such relation to its orbit, that the sun becomes at different periods of the year perpendicular to different portions of the globe, and thus produces the continual succession and order of the seasons, cherishing all nature, and making life delightful.

The stagnation of the ocean is prevented, and the ebb and flow of the tides effected, by the influence of the moon as well as of the sun.

The planets are all placed in definite relations one to another, and each affects the other by mutual attraction. "This subsisting law of attraction falls within limits which utility requires:—If the planet Saturn had attracted the earth in a proportion increasing according to its distance (instead

of the reverse,) it would have dragged the globe out of its course, and have perplexed its motions to a degree incompatible with our security, our enjoyments, and probably our existence."—Paley, chap. xxii. p. 426.

C.

EXTREMES OF ORGANIZED BEING.

6. Elephant—Mouse. 7. Ostrich—Humming-Bird. 8. Skeleton of a Whale—of a Minnow. 9. Crocodile—Microscope and Wheel Animal.

FIRST APARTMENT.

ANATOMICAL RELATIONS.

Man.

1. Casts or statues of the Farnese Hercules and the Venus de Medicis.
2. Wax models from Florence representing dissections.
3. Male and female skeletons.
4. Fœtuses in spirits. Injected preparations, &c.
5. Parts of the skeleton.

a. *Skull.*

Relation to the subsistence of the individual.

It is destined to contain a substance so soft as easily to receive external injury; so important to the continuance of life, that a very slight injury suspends or extinguishes the vital energy. This substance is accordingly enclosed in a strong bony case, "adapted not for motion, but solely for defence. It is lined with soft membranous coats. Hollows and inequalities may be observed in the inside of the skull: these exactly fit the folds of the brain, keeping the substance steady, and guarding it against concussions."—Paley, chap. xi. p. 225.

Relation to the well-being of the individual.

The secure protection of the brain is of the first importance to sensation, the source of all animal delight; which

is

is liable to be disturbed or suspended by less injuries to the brain than those which affect life.

b. The *Spine* in its cavity is a long canal conveying the substance of the brain through a great part of the animal form. Like the skull, it affords to its contents a firm hard covering. Like the skull, it is variously perforated, sending forth minute ramifications of brain through all parts of the body. But, unlike the skull, it is curiously adapted to various motions; none of these motions, however, occasion it to press at any time on any of the fine branches of brain which issue from its cavities. Were not this circumstance most nicely adjusted, every motion of the body would be liable to induce palsy, and to endanger life.

"The head rests immediately on the uppermost of the vertebræ, and is united to it by a hinge joint, upon which joint the head plays freely forward and backward, as far either way as the ligaments allow."—

"The strength of the compages, and the security against luxation is an instance of wonderful contrivance. Where so many joints are concerned, and where in every one derangement would be fatal, a peculiar protection is provided: the vertebræ are articulated; that is, moveable joints between them are formed by means of those projections called processes, which so lock in with and overwrap one another as to secure the body of the vertebra not only from accidental slipping, but even from being pushed out of its place by any violence less than that which would break the bone."

The relations of the spine to the subsistence of the individual are nearly the same with those of the skull: it is further related to the well-being and comfort of animal life by affording the facilities of motion.

c. *Ribs.* These are fixed by strong cartilages at one of their ends to the vertebræ, at the other to the sternum. Their relations to life and well-being are manifest in their adjustment to all the motions of the spine, in the remarkable protection which they afford to the principal organs of life, the heart and the lungs, and their peculiar adaptation to assist the movements of the latter.

d. The *Pelvis* being the centre of bodily motion, in the human

human form, requires peculiar strength. All the larger and stronger muscles of the body, which move the thighs and hind-legs of quadrupeds, move round or are attac ed to it. The bones differ from those above and below them in size and compactness, and derive great firmness from their circular disposition. If great strength was requisite in the covering which was to protect the brain of the individual, no less was needful for that which was to form the shelter, and as it were the antenatal cradle, of the newly conceived being. Here one of the most interesting relations of anatomy is displayed; a relation not only to the safety and well-being of the individual, but also to the continuance of the species, in the remarkable expansion of the bones of the female pelvis beyond those of the male. These, and numerous other formations having similar relations, are obviously formed by a power regarding prospectively their future use.

e. The exact correspondencies of legs, feet, arms, and hands, enable them to cooperate equally and mutually in powerful exertion and in rapid movement.

f. *Teeth.* These are different in different animals; but wherever they are found, a provision is also found for giving those motions to the jaw from which their chief use is derived. A relation then exists between the muscles of the jaw and the solid substance, between the form and substance of the jaw and the teeth, between these and the organs necessary to deglutition, between the latter and the gullet; between that and the stomach; between the stomach and the gastric juice; between this and the absorbents, lacteals, and lymphatics, which secrete the chyle or necessary nutriment, and convey it to the thoracic duct; between this duct and the subclavian and other veins, between veins and arteries, between arteries and lungs, between all and the heart.

g. The mutual relations of muscles and nerves, of muscles to each other, and of nerves to each other, contributing constantly to the security and well-being of individuals and species, will appear to the most cursory observer.

h. Organs of sense. Dissected eye. Ear, nose, and tongue, &c.

"The

" The eye is formed on principles similar to those which are applied to the construction of the telescope or camera obscura. The perception arising from the image is a subject of distinct consideration. The instruments, as far as they relate to the production of the image, are of the same kind. The end is the same ; the means are the same. The lenses of the telescope and the humours of the eye bear a complete resemblance to one another in their figure, in their position, and in their power over the rays of light ; viz. in bringing each pencil to a point at the right distance from the lens : in the eye at the exact place where the membrane of the retina is spread to receive it."—Paley, p. 23.

" The ear is no less artificially adapted to its office than the eye."—" The external ear is calculated to catch and collect the pulses of air—These, passing through the barrel of the ear, strike on the thin membrane known by the name of the drum, which, stretched over bony cavities, presents a concurrence of circumstances very analogous to the construction of that instrument."—Vide p. 46.

The organs of smell direct many, perhaps most, animals to a proper choice of aliment, and greatly contribute to general delight. The internal part of the nose has six cavities, called the maxillary frontal and spheroid sinuses, on each side. These are lined with a thick but very irritable membrane, in which the sensation of smelling certainly begins.

The tongue is covered with irritable papillæ, supposed to be formed by the extremities of its nerves. Its delight in flavours prompts its exertions in the work of deglutition.

The organs of touch are diffused throughout the whole surface of the forms of most animals : perhaps some tribes of insects are alone to be excepted. The cutis (a delicate network of fine vessels, disclosed upon removal of the epidermis, the exterior or scarf skin,) is found to have throughout its whole surface innumerable papillæ, like minute granulations, which are most easily observed where the sense of feeling is most delicate.

i. Relations of individuals to each other.—Hercules and Venus.

The male is almost always more robust than the female.

female. This is requisite in a state in which it is ordained that subsistence shall depend upon exertion: for during the period of parturition, &c., it is necessary that the strength of the male should be exerted for the maintenance of both. The difference between the strength of males and females will be found generally proportionate to the different degrees in which such necessity shall be found to exist.

The teats of females of different species are adapted in size, form, situation and number, to their respective young. "At the moment the young animal enters into the world, its maintenance, the maternal milk, is ready for it."

The new-born child is without teeth. "It is evident that the act of sucking will be performed with more ease, both to the mother and infant, while the edges of the gums are smooth and soft, than when they are bordered with sharp bones. By the time they are wanted the teeth are ready."

The remarkable increase of ingenuity and courage in most brutes during the tender and defenceless state of their young, appears to be a relation of instinct. This impulse of instinct guides the sexes of all species, directs the young to the teat, induces birds to build nests, and brood on their eggs, urges fish from salt to fresh water, and insects to provide for a progeny of which they never live to see the birth.—Ch. xviii.

k. Relations of animals to food, and food to animals. Specimens of teeth, bill, gizzards, and stomachs.

The teeth of animals are adapted to the mastication of varieties of food. Where long-continued mastication and trituration is requisite, the teeth are broad and solid; where less comminution is needful, they are hollow and sharp. "The gastric juice of birds of prey, of an owl, or a kite, acts upon animal fibre alone, will not act upon seed and grasses at all. The gastric juice of ruminating animals, as the sheep and the ox, speedily dissolves vegetables, but makes no impression upon animal bodies." The construction of the stomachs of ruminating animals differs considerably from that of animals which require animal food. Birds furnished with soft bills are provided with gizzards necessary to triturate their grain. Those which possess hard, strong, and hooked bills and claws, whose gastric juices will

will not act on grain, have soft membranous stomachs. The teeth and stomachs of mankind are suited to the mastication and digestion both of animal and vegetable food.

Skeletons or preserved specimens of parts should be introduced wherever they are requisite to illustrate peculiar organization.

CLASS I. MAMMALIA,

According to the Linnæan arrangement, includes all animals that suckle their young; which also correspond in other respects; in the heart, which has two ventricles and two auricles; and in the blood, which is red and warm. They are likewise all viviparous.

DIVISION I. *Digitated* or *Clawed.*

ORDER I. PRIMATES. Fore teeth four. Canine single.

Relations to sustenance, well-being, &c.

GENERA.

Man.

Ape. Relation to man. "Notwithstanding the great similarity between the form and organization of the Ouran-Outang—though he has the same organs of speech, he never attempts to articulate. The figure and proportion of his brain likewise are the same; but he discovers no extent of thought. There cannot, M. Buffon properly remarks, be a more evident proof that matter alone, though perfectly organized, can produce neither language nor extensive thinking, unless it be animated by minds superior to those of brutes. Ouran-Outangs imitate almost all human actions except speech."—Smellie, Phil. of Nat. Hist. vol. ii. p. 423.

Macauco.

Bat. Relation of conservation. If the bat did not sleep during the winter it must starve, as the insects upon which it feeds disappear.—Paley and Smellie.

Relation

Relation of compensation. The hook in the wing of a bat is strictly a mechanical and compensating contrivance. Without her hook the bat would be the most helpless of all animals. She can neither run upon her feet, nor raise herself from the ground. By her hook she suspends herself to the sides of rocks, caves, and buildings.

ORDER II. BRUTA. Fore teeth or incisors none.

GENERA.

Elephant. Relations of conservation. Superior sagacity. Tusks not formed till the sucking-time ceases. Length and position of the tusks. Various powers of the proboscis.

Relations of compensation. "The necessity of the elephant's proboscis arises from the shortness of his neck: the shortness of the neck is rendered necessary by the weight of the head, &c."—Paley.

Walrus. Conservation.

Morse. Preserved by their blubber amidst regions of Arctic ice, and enabled to cope with their only enemy the white bear by their tremendous tusks.

Relation of compensation. Their soft enormous bodies, though possessing much activity in water, are most unwieldy on land; but they are enabled to ascend the rocks of ice by means of their tusks, which they fix in the crevices, and so draw themselves out of the sea.

Sloth. Relations of conservation and compensation.

It is enabled to subsist for a long time without food. Its inaptitude for locomotion is compensated by an extraordinary strength of claws, and by its power of climbing. "The tardiness of his pace seems to have reference to the capacity of his organs, and to his propensities with respect to food."—Paley, 308.

Ant-Eater. Relations.

Peculiar construction of snout and tongue—Strong claws for defence.

Manis. Relations. Its food is of insects. The tongue covered with a viscus, by which they are ensnared. It is slow of motion, but securely protected from most enemies by a strong scaly armour.

Armadillo. Relations of conservation. Covered with a hard bony shell, it is said to escape from pursuers by rolling itself like a ball, and dropping from the edge of a precipice. It burrows deep in the ground.

Order III. Feræ.

Fore teeth six, two, and ten in the upper jaw; two, four, and eight, in the lower. One canine on each side in all genera.

GENERA.

Seal. Relations of conservation and compensation.—Adaptation to long continuance in and under water, and swiftness in diving and swimming. No external ears. Hind feet palmated. Quære respecting foramen ovale.—See Derham, Physico-Theol. 157 and 325.

Dog. Relations, &c. Acute sense of smelling. Strength and activity. "Adaptation of wide gullet to a voracious appetite."—Derham, Ph. Theol. 197.

Cat. (including the Lion and Tiger.) Relations, &c. Superior strength and activity. Power of expanding or closing the pupil of the eye.—Paley, 257.

Sharp retractile claws. Activity of gastric juice and shortness of intestine.—Paley, 246.

Civet. Fetid odour emitted by the skunk when pursued.

Weasel. Relations of organization to sustenance and security, &c.

Bear. Strength of paws. Power of long abstinence from food during the winter.

Opossum. "A false skin under the belly of the animal forms a pouch, into which the young litter are received at their birth. It is furnished with peculiar bones and muscles, which serve to open and to close the bag."—Paley, 266.

Mole.

Mole. "The strong short legs, the palmated feet armed with sharp nails, the pig-like nose, the teeth, the velvet coat which is never soiled, the small external ear, the sagacious smell, the sunk protected eye, all conduce to the utilities or to the safety of its underground life."—Paley, p. 293.

Shrew.

Hedge Hog. A guard of sharp prickles—Quære whether less sensible of pain than other animals. See Derham, note, p. 240. Dormant during winter. Smellie, vol. ii. p. 411.

ORDER IV. GLIRES. Fore teeth two, canine none.

GENERA.

Porcupine. Protected like the hedge-hog.

Hare. The ears of the hare and other animals of flight are turned backwards, those of beasts of prey and pursuit forwards.—Paley, 256.

Its eyes take in a great range of vision. It runs with ease up hill.

Beaver. *Castor.* *Fiber.* A plastering species, endued with a natural trowel, possessing singular sagacity. The fore feet small with divided claws; the hind feet united by a membrane for swimming.—Beavers thus dive with swiftness exceeding that of the fish on which they prey.

Rat.

Squirrel. Blood not exceeding the heat of the external air. Sleeps during the severity of winter. Some are provided with membranes which enable them to extend their leap to a short flight.

DIVISION II. *Hoofed.*

ORDER V. PECORA. Fore teeth, none above.

GENERA.

Camel. Relations of organization, &c., to sustenance and well being. "The stomach of the camel is well known to retain large quantities of water, and

to retain it unchanged for a considerable length of time. This property qualifies it for living in the Desert."—Paley.

The soft callous foot is peculiarly adapted to sandy regions.

Musk.

Deer. "Where the substance on which animals feed is of slow concretion, the intestines are proportionally long. Those of a Canadian stag four feet in height, measured 96 feet."—Paley, p. 246.

Goat.

Sheep. "The wild sheep (like the preceding) is swift and active; and if it lose these qualities when it comes under the subjection of man, the loss is compensated by his protection."—Paley.

Ox. Strength of neck and horns. Stomach formed for rumination.

ORDER VI. BELLUÆ. Fore teeth above and below, obtuse.

GENERA.

Horse. Strength, swiftness, power of long continued speed. Stomach formed for rumination.

Hippopotamus. Able to walk under the water as easily as on land. By his prodigious strength, especially of jaws, he overcomes and devours crocodiles; he takes fish by swimming. On land he eats rushes, millet, grass, sugar canes, &c.

Hog. "The babyrouessa hitches its crooked tusks on the branch of a tree; then suffers its whole body to swing from it. Thus it continues during the night secure from animals which hunt it for prey."—Paley, 271.

Rhinoceros. Defended by its great strength, the peculiar position of its horn, and the thickness of its hide.

DIVISION III. *Without Claws or Hoofs.*

ORDER VII. CETE.

GENERA.

Narwal. Means of defence and offence, two long, straight, spiral teeth perforating the upper lip.

Whale.

Whale. Feeds on myriads of medusæ, which it drinks in with the sea water. These and other small fish are entangled in parallel hairy laminæ, of which about 700 adhere to the upper jaw. The water is ejected through two orifices near the middle of the head. When attacked it strikes with the tail. The sound from the stroke of the tail on the water is said to exceed the report of a cannon.

Cachalot.—

Dolphin.—

CLASS II. AVES.

Heart and blood as in the former class. Oviparous.

Latham's Arrangement.

DIVISION I. *Land Birds.*

Order I. Accipitres.

Relations, &c.

Rapacious. Hooked bill; superior mandible near the base extending beyond the inferior.

"Birds of prey, by their talons and beaks, are qualified to seize and devour many species, both of other birds and of quadrupeds. The constitution of the stomach agrees exactly with the form of the members. The gastric juice of a bird of prey, of an owl, a falcon, or a kite, acts upon the animal fibre alone, not at all on seeds or grasses."—Paley.

Order II. Picæ.

Pies. The parrot is of this order, remarkable for the compensatory motion of the upper bill.—Paley, 301. Bill convex, compressed.

Order III. Passeres.

Sparrow tribes. Conical sharp pointed bills. Migration of swallows.

Order IV. Columbæ.

Pigeon tribes. Long nostrils covered with soft loose mem-

brane; eject a milky substance from the craw to feed their young.—Montague. Ornithol. Dict. Introduction.

ORDER V. GALLINÆ.

Cock tribes. Analogy between their stomachs and the structure of corn-mills.—Paley, 287. Margin of the upper mandible folds over the inferior.

ORDER VI. STRUTHIONES.

Ostrich tribes. The wings of the ostrich are unfit for flying: the feathers are not compacted in their laminæ like those of other birds.

DIVISION II. *Water Fowl.*

ORDER VII. GRALLÆ.

Waders. Cloven footed. In water fowl the oil bag is particularly conspicuous.

ORDER VIII. GRALLÆ.

Waders. Pinnated feet.

ORDER IX. ANSERES.

Web footed. Dentated filtering bill of the duck, furnished with large nerves, enabling it minutely to examine the liquids containing its food, and probably increasing its gratification.—Paley, 241.

N. B. I have noticed but cursorily the orders, and have omitted the ninety-six genera of birds, as my object is to illustrate the proposed plan, and not in this place to attempt a completion of the necessary detail. In touching on other classes I shall accordingly be still more concise.

CLASS III. AMPHIBIA.

Heart with one ventricle, and one auricle. The blood cold and red. Animals of this class respire at will with lungs: have no molares or grinding teeth.

ORDER I. Chiefly inhabit land, but occasionally water.

II. Chiefly the water, but occasionally the land.

Crocodiles,

Crocodiles, lizards, frogs, eels, serpents, and sea tortoises are of this class. Their command over the lungs; the structure of the heart, and other peculiar organizations, manifest an original destination to either element.

CLASS IV. PISCES.

Heart with one ventricle and one auricle: blood cold and red. They breathe by gills. "The ordinary shape of a fish's eye being much more convex than that of land animals, a corresponding difference attends its muscular conformation, viz. that it is throughout calculated for flattening the eye.—The fins are placed in such relation to each other as exactly to balance the body of the fish in the attitude best suited to all conveniences of life. The tails of fish are adapted to progressive motion in water; those of warm-blooded water animals, as Order 7, Cete, Mammalia, are horizontal, or principally adapted to perpendicular motion, having relation to their necessity of rising every two or three minutes to the surface to take breath. Among the peculiar organizations of fish, the most remarkable is the air bladder; the distention or contraction of which facilitates their ascent and descent in water."—Paley. The peculiar muscular organization of fishes has been lately developed in an interesting manner by Mr. Carlisle, at the Royal Society.

Order I. *Nantes.* Gills and lungs. Rays of fins cartilaginous.

II. *Apodes.* No ventral fins.

III. *Jugulares.* Ventral placed before the pectoral fins.

IV. *Thoracici.* Ventral fins under the thorax.

V. *Abdominales.* Ventral fins in the abdomen behind the thorax.

Sixty-one Genera.

CLASS V. INSECTÆ.

One ventricle, without an auricle; with antennæ.

In addition to the peculiar organization of insects, the

unquestionable characters of instinct, of a superior power which directs their voluntary exertions, both to the sustenance of individuals and to the preservation of species, must excite strong interest in the student of Natural Theology. For the sake of brevity, I shall here give only a general reference to Paley, chap. xix. p. 346.

ORDER I. *Coleoptera.* Sheath wings, like chafers; the upper wing covers are called elytra; these, in most, cover the abdomen; but in some are partial, as in the earwig.

II. *Hemiptera.* Elytra half membranaceous, half crustaceous, incumbent on each other. Grasshoppers are of this order.

III. *Lepidoptera.* Four membranous wings, scaly or powdered. Butterflies.

IV. *Neuroptera.* Membranous wings reticulated with nerves, without sting. Dragon Flies, &c.

V. *Hymenoptera.* Four transparent wings, with stings. Bees, &c.

VI. *Diptera.* With only two wings; but with alteres, or poisers, instead of under wings. Flies, Gnats, &c.

VII. *Aptera.* Without wings. Spiders, Scorpions, Fleas, Lobsters, &c.

CLASS VI. VERMES.

One ventricle without an auricle; a cold colourless sanies for blood. "The play of the rings in an earth worm as it crawls; the undulatory motion propagated along the body; the beards or prickles with which the annuli are armed, and which the animal can either shut up close to its body, or let out to lay hold of the roughnesses of the surface on which it creeps—afford, when compared with the provisions for motion in other animals, proofs of new and appropriate mechanism."—Paley, 313.

ORDER I. *Intestina.* II. *Mollusca.* III. *Testacea.* IV. *Lithophyta.* V. *Zoophyta.*

80 Genera—1166 Species.

SHELLS.

SHELLS.

The shells of the third order of vermes are so various and so beautiful as to deserve a distinct place in the Exhibition. They are commonly arranged in three ORDERS: I. *Multivalves.* II. *Bivalves.* III. *Univalves.*—See Paley, 306, 307. Thirty-six Genera.

PLANTS.

Pictures and dried specimens displaying the characteristics and interesting peculiarities of classes, orders, genera, &c.

We discover in plants, as well as in animals, numerous relations to the preservation of individuals, and of species; but we perceive also a limitation of the faculty of motion, which renders it doubtful whether any of their movements are spontaneous, or can be considered as proceeding from internal power, independent of the immediate agency of some external force attractive, repulsive, or impulsive.

Their forms, like those of animals, are composed of heterogeneous particles, which, when once separated, display no tendency to reunite in similar form. They are composed in great measure of numerous tubes, which convey juices to each part necessary to nutrition and to growth. The period of vegetable like that of animal form is limited;—of various extent in different species. Like animals, plants grow to a limited magnitude according to their species, and, having attained to a certain growth, soon tend to decay.—Moderate heat and light are requisite to their sustenance or well-being. They are subject to variations of health, from defect or excess of nutriment. The organization of some is adapted to subsistence in water. Watry situations are destructive to others. Relations exist between different parts of vegetable forms, and between different individuals, on which depends the continuance of their species. Plants are incapable of locomotion; but provisions are ordained for the conveyance of their seeds to proper distances, that they may have room for growth. Analogies of plants to animals may be specified to a great extent; and in the com-

pletion of this scheme may be referred to the respective classes, orders, &c. It may suffice here to observe, that the most important difference between the animal and vegetable appears to be, that constant means are every where provided for conveying to the stationary plant whatsoever is necessary to its subsistence, and to the continuance of the species; while the locomotive animal is left to seek such means for itself. The vegetable appears to possess life and very limited sensation; but neither thought nor voluntary power. In the animal, all relations to the subsistence of the individual, and to the continuance of the species, are wholly subject to the exertions of thought, or of voluntary power, or of both united.——24 Classes.

PETRIFACTIONS.

These are Nature's archives, and they record a stupendous and miraculous change which has been wrought at a distant period over the whole surface of the globe. One cabinet should be arranged according to the several classes, orders, &c., of animals and plants to which they appear to belong: but another, and indeed the principal, collection of organic remains should be classed according to the order of the strata in which they are found, with specimens of the strata; carefully distinguishing the gravel fossils, or those found in alluvial deposits; likewise the peat or surface fossils; and those belonging to the existing race buried by known means, from original fossil remains of the regular strata. Where the order of the strata is not known, or is doubtful, an arrangement of clay, sand, limestone, &c. fossils by themselves will facilitate a future identification of them, when others are obtained from known strata.

A partial attempt has been made by Mr. W. Smith, author of an Essay on Draining, to form a collection arranged according to the order of strata.

MINERALS.

The characteristics of animated forms are rendered more conspicuous from being contrasted with inanimate forms,

in

in which we do not discover any mutual relations of parts, or of distinct forms to the subsistence of other parts or forms. They are not formed by gradual growth. Their period of duration appears to have no fixed limit. Their particles unite by mutual attractions; and after separation by external force, are found to reunite as perfectly as before such separation. They are chiefly distinguished one from another by variety of colour, difference of transparency and opacity, weight, hardness, ductility, fusibility in heat, difference of mutual attractions; by the sound caused in their concussion, their smell and taste, their peculiarity of fracture, and by the regularity of solid forms which they are severally found to assume, after solution, in assignable degrees of temperature. The ordinary visible characteristics, colour, gloss, fracture, &c., recorded by Werner; the crystalline forms enumerated by Haüy; the weight and mutual attractions ascertained by various philosophers and chemists, are to be found collected together in several modern Treatises on Mineralogy, and should accompany the reference to each specimen in the Catalogue of the National Museum.

XLVII. *On the Quantity of Carbon in Carbonic Acid, and on the Nature of the Diamond.* *By* William Allen, *Esq.* F.L.S. *and* William Hasledine Pepys, *Esq.*

[Continued from p. 227.]

Second Experiment on Diamond.

Thermometer 48° Fahrenheit, barometer 30·08. Oxygen gas made as usual, left a residuum of 3 parts in 100.

Eleven small diamonds, weighing 4·01 grains, were put into the tray. We began with 49·84 cubic inches of oxygen; and every thing being properly adjusted, kept the platina tube red-hot for a quarter of an hour, and during this time the gas was passed from one gasometer to the other, as in the former experiments. When the tubes, &c. were cooled down to the temperature of the room, all the gas

gas was transferred to gasometer No. 1. and the volume was exactly the same as before the experiment. On examining the tray, all the diamonds were entirely consumed, and not a vestige left.

Lime water absorbed 57·5 parts from 100.
The test for oxygen 39·5
Residuum - 3

800

Correction for temperature.

60°	0·103	49·84
48	12	1·23
12 diff.	1·236 add for temp.	51·07

Correction for pressure.

30 : 30·08 : : 57·07 : 61·20.

The volume of gas at the mean was therefore 51·20 cubic inches.

100 : 57·60 : : 51·20 : 29·44.

Then 29·44 cubic inches of carbonic acid gas were produced.

100 : 47·26 : : 29·44 : 13·91.

13·91 : 4·01 : : 100 : 28·82.

Then, according to this experiment, 100 grains of carbonic acid contain 28·82 diamond.

Calculation by oxygen.

100 : 33·82 : : 29·44 : 9·95 grains of oxygen consumed
4·01 of diamond

13·96
Calculation by carbonic acid 13·91

·05 difference.

13·96 : 4·01 : : 100 : 28·72.

Then, calculating by the weight of oxygen employed, 100 grains of carbonic acid contain 28·72 diamond.

The precipitate in lime water from the gas produced in the combustion of diamond, appeared to us denser than that from the combustion of charcoal.

In

In order to see how far the weight of the precipitate of carbonate of lime would agree with the results of the foregoing experiments, we drew off 20·5 cubic inches of the gas which had been thus altered by the combustion of diamond in the last experiment by the register H, and received it in bottles over mercury; then admitting lime water, we obtained a copious precipitate of carbonate of lime, which being dried at the temperature of 212° Fahrenheit, weighed 12 grains.

But as the 20·5 cubic inches require the same corrections to bring them to the mean temperature and pressure; we say, as the actual volume of all the gas is to its correction, so is the quantity drawn off to that which it would have been at the mean:

49·84 : 51·20 : : 20·50 : 21·06, the volume after the corrections were made.

Then, to find how much carbonic acid was contained in these 21·06 cubic inches, we state it thus: As the total quantity of gas after the experiment is to the total weight of carbonic acid gas found by calculation, so is the quantity of gas experimented upon to the weight of carbonic acid gas which it ought to have contained,

51·20 : 13·91 : : 21·06 : 5·72 grains.

Every 100 grains of precipitated carbonate of lime contain 44 grains of carbonic acid; 12 grains were procured in our experiment. 100 : 44 : : 12 : 5·28

Therefore the carbonic acid contained in our precipitate of 12 grains weighed 5·28; by calculation it should have weighed 5·72; this is as near as we had a right to expect from the difficulty of collecting the precipitate.

Stone Coal.

Upon the suggestion of our mutual friend Professor Davy, we next examined the results of the combustion of stone coal and plumbago; thermometer 57° Fahrenheit, barometer 29·65.

The stone coal from Wales, employed by maltsters, is well known to contain little or no maltha or mineral pitch, and to burn without flame.

A portion

A portion of this coal was placed under sand in a crucible, and exposed to a strong heat for one hour; 4 grains of it thus prepared were put into the tray: our oxygen left a residuum of 5 parts in 100, and we began with 49·84 cubic inches as usual. The tray being placed in the platina tube was heated to redness for about 10 minutes. When the gas was first passed, we thought we saw a flash in the glass tubes. On suffering the whole to cool the quantity of gas still remained the same, and the tray being drawn out contained only ·5 of a grain unconsumed. From the gas thus charged with 3·5 grains of coal,

Lime water absorbed	53	parts from 100.
The tests for oxygen	39	
Residuum -	8	or an increase of 3.
	100	

Correction for temperature.

60°	0·103	49·84
57	3	·30
3 diff.	0·309 add for temp.	50·14

Correction for pressure.

30 : 29·65 : : 50·14 : 49·55.

The quantity of oxygen at the mean was therefore 49·55 cubic inches.

100 : 53 : : 49·55 : 26·26.

Consequently 26·26 cubic inches of carbonic acid gas were produced.

100 : 47·26 : : 26·26 : 12·41 grains.

12·41 : 3·50 : : 100 : 28·20.

Then, according to this experiment, 100 grains of carbonic acid gas contain 28·20 of coal.

Calculation by oxygen.

100 : 33 82 : : 26·26 : 8.88 grains of oxygen consumed.

3·50 coal

12·38

Calculation

Calculation by carbonic acid	12·41
by oxygen	12·38
difference	·03

Here, contrary to what happened in other experiments, the calculation by carbonic acid rather exceeds that by oxygen:

12·38 : 3·50 : : 100 : 28·27.

Calculating therefore by oxygen, 100 grains of carbonic acid contain 28·27 of coal.

Experiment with Plumbago.

Thermometer 44° Fahrenheit, barometer 29·94.

4 grains of plumbago, from a very fine specimen belonging to Dr. Babington, were put into the tray. Our oxygen left a residuum of 2 parts in 100, and we began with 49·84 cubic inches. The tray, with its contents, being placed in the platina tube, was heated to redness for a quarter of an hour, and the gas made to pass over it several times. When all was cool, the original quantity was neither increased nor diminished, and on withdrawing the tray we found only ·2 of a grain of oxide of iron; so that this specimen of plumbago contains only 5 per cent. oxide of iron.

The gas being now examined,

Lime water absorbed	55	parts from 100
The tests for oxygen	42	
Residuum -	3	or an increase of 1 per cent.
	100	

Correction for temperature.

60°	0·103	49·84
44	16	1·64
16 diff.	1·648 add for temp.	51·48

Correction for pressure.

30 : 29·94 : : 51·48 : 51·37.

The quantity of oxygen at the mean would be 51·37 cubic inches.

100 : 55 : : 51·37 : 28·25.

Therefore 28·25 cubic inches of carbonic acid gas were produced.

100 : 47·26 : : 28·25 : 13·35 grains.

13·35 : 3·8 : : 100 : 28·46.

Then, according to this experiment, 100 grains of carbonic acid contain 28·46 of the carbonaceous part of the plumbago.

Calculation by oxygen.

100 : 33·82 : : 28·25 : 9·55 grains of oxygen consumed 3·80 plumbago.

13·35

Calculation by carbonic acid 13·35

First Experiment on Animal Charcoal.

Thermometer 60° Fahrenheit, barometer 30·23.

Muscular fibre distilled in a coated glass retort left a black shining coal, 4 grains of which were put into the tray. Our oxygen left a residuum of 2 parts in 100. The tray and its contents being placed in the platina tube, was heated to redness for 8 minutes. The first time the gas was passed, a lambent flame filled the whole length of the glass tube, and the gas became turbid or milky. It was passed frequently through the heated tube, but we observed no repetition of the flashes. Hence we conjecture, that if the diamond had contained hydrogen we should probably have had a similar appearance. After the experiment all the apparatus was, as usual, perfectly tight, and the volume of gas unaltered. On examining the platina tray a minute portion of charcoal remained, and a quantity of saline matter adhered to it so firmly, that it became difficult to ascertain the quantity of carbon consumed, and we forbore to make the calculation; we however examined the gas.

Lime water absorbed	40	parts from 100
The tests for oxygen	54	
Residuum -	6	or an increase of 4 per cent.
	100	

Second

Second Experiment on Animal Charcoal.

Thermometer 59° Fahrenheit, barometer 29·45.

Some of the animal charcoal of last experiment was heated to redness under sand for one hour. 4 grains were placed in the platina tray; and as we were so much embarrassed in the last experiment with the saline matter which adhered to the tray, we exactly balanced it with its contents. Our oxygen, made as usual, left a residuum of 2 parts in 100, and we began with 49·84 cubic inches. When every thing was adjusted, and the platina tube red-hot, on passing the oxygen, flashes resembling lightning ran along the glass tube; and this was repeated 5 or 6 times. The whole of the gas became very cloudy, exhibiting a turbid milky appearance. The tube was rendered white-hot by the combustion of the carbonaceous matter in oxygen. The fire was kept up about 8 minutes, and the gas passed several times. When all was cool, we could observe no alteration in the volume of gas by the register. The tray contained a mixture of salts; and, being weighed, was lighter by 3·2 grains. This loss was not wholly carbon, for it is well known that animal substance contains a variety of salts, as phosphates, muriates, &c., some of which, though not volatile in a low red heat, might be decomposed and dissipated in the intense white heat produced by the combustion of the carbonaceous matter in oxygen; and we accordingly found the internal parts of the gasometers and tubes very slightly covered with a sort of efflorescence. On examining the gas after the experiment,

Lime water absorbed	41	parts from 100
The tests for oxygen	55	
Residuum -	4	or an increase of 2.
	100	

Correction for temperature.

60°	49·84
59	·10 add for temp.
1 diff. or 0·103	49·94

Correction for pressure.

30 : 29·45 : : 49·94 : 49·02.

The quantity of oxygen at the mean would therefore be 49·02 cubic inches.

100 : 41 : : 49·02 : 20·09

The carbonic acid gas produced was therefore 20·09 cubic inches.

100 : 47·26 : : 20·09 : 9·49

and this carbonic acid weighed 9·49 grains.

Now the coal in the tray had lost 3·2 grains; but as the whole of this was not carbon, but part of it volatile saline matter, &c., we shall endeavour to estimate the carbon by the experiment on plumbago. When 13·35 grains of carbonic acid contained 3·80 grains of carbon,

13·35 : 3·80 : : 9·49 : 2·70.

The quantity of carbonic acid produced in this experiment, therefore, contained 2·70 grains of carbon.

Loss	3·20
Carbon	2·70
Leaves	·50 for volatile saline matter, &c.

So that, this being granted, the present experiment agrees with the foregoing.

In two of our first experiments with box-wood charcoal, the calculations gave us in one case 29·75 parts of carbon in 100 of carbonic acid, and in the other 30·68; but we were not then fully aware of the absorption of water by charcoal, which rendered the quantity of real carbon employed less than indicated by the weight. Also in another experiment, in which 4 grains of diamond were consumed, the calculation gave us 29·96 per cent. of diamond in carbonic acid; but apprehending that a slight degree of inaccuracy had crept into this experiment, we have not detailed it with the rest; but we have thought it right to give a simple statement of matters of fact; in no one instance have we endeavoured to strain or accommodate these to suit any particular theory, being fully aware that every experiment, carefully made and faithfully recorded, will remain an immutable truth to the end of time, while hypotheses are constantly

constantly varying, and even the most beautiful theories are liable to change.

The experiments above related give us the following results:

	By carbonic acid.	By oxygen.
Box-wood charcoal	28·92	28·77
1st expt. diamond	28·95	28·81
2d expt. diamond	28·82	28·72
Stone coal -	28·20	28·27
Plumbago -	28·46	28·46
	5)143·35	5)143·03
mean	28·67	28·60

Hence we conclude that 100 grains of carbonic acid contains 28·60 of carbon, which does not greatly differ from the results of the experiments of Smithson Tennant, esq. on the nature of diamond.—See Phil. Trans. 1797.

This gentleman made his experiment in the following manner: A quarter of an ounce of nitrate of potash was rendered somewhat alkaline by exposure to heat, in order that it might more readily absorb carbonic acid; it was then put into a gold tube with 2½ grains of diamond; and being subjected to heat, the diamond was converted into carbonic acid, by uniting with the oxygen contained in the nitric acid. The carbonic acid thus produced combined with the potash; and on pouring a solution of muriate of lime into a solution of this salt, he obtained a precipitate of carbonate of lime: this being decomposed by muriatic acid, gave as much carbonic acid gas as occupied the space of 10·1 ounces of water. The thermometer was at 55° Fahrenheit, the barometer 29·80. In a second experiment he procured a larger quantity, or equal to 10·3 ounces of water.

If we therefore consider an ounce of water as consisting of 480 grains, and a cubic inch of water equal to 253 grains, and then make the proper corrections for temperature and pressure, one of his experiments will give about 27 per cent. the other about 27·80 for the carbon in carbonic acid, which is somewhat less than our estimate; but the difference may easily be accounted for, from the different methods employed

The experiments of Guyton, as detailed in the *Annales de Chimie*, vol. xxxi. page 76, are liable to very strong objections; but at the same time the candid manner in which he has related every circumstance merits considerable praise. It is impossible, however, not to observe, that the quantity of gas before and after the experiment could not, from the construction of his apparatus, be very rigorously ascertained. We object also to nitrous gas as a test for oxygen; and as it is acknowledged that the wooden support included in the oxygen gas took fire, the product of carbonic acid must have been influenced by it; so that, if no chance of error had existed in estimating the carbonic acid gas from the residuum after barytic water had absorbed a part, still the result would not have been satisfactory.

The experiments which we have had the honour of laying before this society prove several important points:

1st. That the estimate given by Lavoisier, of 28 parts of carbon in every 100 parts of carbonic acid, is very nearly correct; the mean of our experiments makes it 28·60.

2dly. That the diamond is pure carbon; for, had it contained any notable proportion of hydrogen, it must have been discovered, either by detonating with the oxygen, as in the case of animal charcoal, or by diminishing the quantity of oxygen gas.

3dly. That well burnt charcoal contains no sensible quantity of hydrogen; but if exposed to the air for a few hours it absorbs moisture, which renders the results uncertain.

4thly. That charcoal can no longer be considered as an oxide of carbon, because, *when properly prepared*, it requires quite as much oxygen for its combustion as the diamond. This is also the case with stone coal and plumbago.

5thly. It appears that diamond and all carbonaceous substances (as far as our present methods of analysis are capable of demonstrating their nature) differ principally from each other in the state of aggregation of their particles. Berthollet has well remarked, that in proportion as this is stronger, decomposition is more difficult: and hence the variety of temperatures required for the combustion of different inflammable substances.

XLVIII. *Me-*

XLVIII. *Memoirs of the late* Erasmus Darwin, *M. D.*

[Continued from p. 162.]

HIS NOSOLOGY continued.

The Orders and Genera of the Second Class of Diseases.

CLASS I.

DISEASES OF SENSATION.

ORDO I.

Increased Sensation.

GENERA.

1. With increased action of the muscles.
2. With the production of new vessels by internal membranes or glands, with fever.
3. With the production of new vessels by external membranes or glands, with fever.
4. With the production of new vessels by internal membranes or glands, without fever.
5. With the production of new vessels by external membranes or glands, without fever.
6. With fever consequent to the production of new vessels or fluids.
7. With increased action of the organs of sense.

ORDO II.

Decreased Sensation.

GENERA.

1. With decreased actions of the general system.
2. With decreased actions of particular organs.

ORDO III.

Retrograde Sensitive Motions.

GENERA.

1. Of the arterial system.
2. Of the absorbent system.
3. Of the excretory ducts.

The Orders, Genera, and Species, of the Second Class of Diseases.

CLASS II.

DISEASES OF SENSATION.

ORDO I.

Increased Sensation.

GENUS I.

With Increased Action of the Muscles.

SPECIES.

1. *Deglutitio.*	Deglutition.
2. *Respiratio.*	Respiration.
3. *Sternutatio.*	Sneezing.
4. *Anhelitus.*	Panting.
5. *Tussis ebriorum.*	Cough of inebriates.
6. *Singultus.*	Hiccough.
7. *Asthma humorale.*	Humoral asthma.
8. *Nictitatio sensitiva.*	Winking from pain.
9. *Oscitatio et pandiculatio.*	Yawning and stretching.
10. *Tenesmus.*	Tenesmus.
11. *Stranguria.*	Strangury.
12. *Parturitio.*	Parturition.

GENUS II.

With the Production of new Vessels by internal Membranes or Glands, with Fever.

SPECIES.

1. *Febris sensitiva irritata.*	Sensitive irritated fever.
2. *Ophthalmia interna.*	Inflammation of the eye.
3. *Phrenitis.*	———— of the brain.
4. *Peripneumonia.*	———— of the lungs.
———— *trachealis.*	———— the croup.
5. *Pleuritis.*	———— of the pleura.
6. *Diaphragmitis.*	———— of the diaphragm.
7. *Carditis.*	———— of the heart.
8. *Peritonitis.*	———— of the peritoneum.
9. *Mesenteritis.*	———— of the mesentery.
10. *Gastritis.*	———— of the stomach.

11. *En-*

11. *Enteritis.*	Inflammation of the bowels.
12. *Hepatitis.*	——— of the liver.
13. *Splenitis.*	——— of the spleen.
14. *Nephritis.*	——— of the kidney.
15. *Cystitis.*	——— of the bladder.
16. *Hysteritis.*	——— of the womb.
17. *Lumbago sensitiva.*	——— of the loins.
18. *Ischias.*	——— of the pelvis.
19. *Paronychia interna.*	——— beneath the nails.

GENUS III.

With the Production of new Vessels by external Membranes or Glands, with Fever.

SPECIES.

1. *Febris sensitiva inirritata.*	Sensitive inirritated fever.
2. *Erysipelas irritatum.*	Erysipelas irritated.
——— *inirritatum.*	——— inirritated.
——— *sensitivum.*	——— sensitive.
3. *Tonsillitis interna.*	Angina internal.
——— *superficialis.*	——— superficial.
——— *inirritata.*	——— inirritated.
4. *Parotitis suppurans.*	Mumps suppurative.
——— *mutabilis.*	——— mutable.
——— *felina.*	——— of cats.
5. *Catarrhus sensitivus.*	Catarrh inflammatory.
6. ——— *contagiosus.*	——— contagious.
——— *equinus et caninus.*	——— among horses and dogs.
7. *Peripneumonia superficialis.*	Superficial peripneumony.
8. *Pertussis.*	Chin-cough.
9. *Variola discreta.*	Small-pox distinct.
——— *confluens.*	——— confluent.
——— *inoculata.*	——— inoculated.
10. *Rubeola irritata.*	Measles irritated.
——— *inirritata.*	——— inirritated.
11. *Scarlatina mitis.*	Scarlet fever mild.
——— *maligna.*	——— malignant.
12. *Miliaria sudatoria.*	Miliary fever sudatory.

Miliaria irritata.	Miliary irritated.
——— *inirritata.*	——— inirritated.
13. *Pestis.*	Plague.
——— *vaccina.*	——— of horned cattle.
14. *Pemphigus.*	Bladdery fever.
15. *Varicella.*	Chicken-pox.
16. *Urticaria.*	Nettle rash.
17. *Aphtha sensitiva.*	Thrush sensitive.
——— *irritata.*	——— irritated.
——— *inirritata.*	——— inirritated.
18. *Dysenteria.*	Bloody flux.
19. *Gastritis superficialis.*	Superficial inflammation of the stomach.
20. *Enteritis superficialis.*	——————— of the bowels.

GENUS IV.

With the Production of new Vessels by internal Membranes or Glands, without Fever.

SPECIES.

1. *Ophthalmia superficialis.*	Ophthalmy superficial.
——— *lymphatica.*	——— lymphatic.
——— *equina.*	——— of horses.
2. *Pterigion.*	Eye-wing.
3. *Tarsitis palpebrarum.*	Red eyelids.
4. *Hordeolum.*	Stye.
5. *Paronychia superficialis.*	Whitlow.
6. *Gutta rosea hepatica.*	Pimpled face hepatic.
——— *stomatica.*	——— stomatic.
——— *hereditaria.*	——— hereditary.
7. *Odontitis.*	Inflamed tooth.
8. *Otitis.*	——— ear.
9. *Fistula lacrymalis.*	Fistula lacrymalis.
10. *Fistula in ano.*	Fistula in ano.
11. *Hepatitis chronica.*	Chronical hepatitis.
12. *Scrophula suppurans.*	Suppurating scrophula.
13. *Scorbutus suppurans.*	Suppurating scurvy.
14. *Scirrhus suppurans.*	Suppurating scirrhus.
15. *Carcinoma.*	Cancer.
16. *Arthrocele.*	Swelling of the joints.

17. *Ar-*

17. *Arthropuosis.* Suppuration of the joints.
18. *Caries ossium.* Caries of the bones.

GENUS V.

With the Production of new Vessels by external Membranes or Glands, without Fever.

SPECIES.

1. *Gonorrhœa venerea.* Clap.
2. *Syphilis.* Venereal disease.
3. *Lepra.* Leprosy.
4. *Elephantiasis.* Elephantiasis.
5. *Framboesia.* Framboesia.
6. *Psora.* Itch.
7. *Psora ebriorum.* Itch of drunkards.
8. *Herpes.* Herpes.
9. *Zona ignea.* Shingles.
10. *Annulus repens.* Ring-worm.
11. *Tinea capitis.* Scald-head.
12. *Crusta lactea.* Milk-crust.
13. *Trichoma.* Plica polonica.

GENUS VI.

With Fever consequent to the Production of new Vessels or Fluids.

SPECIES.

1. *Febris sensitiva.* Sensitive fever.
2. —— *a pure clauso.* Fever from concealed matter.
3. —— *a vomica.* —— from vomica.
4. —— *ab empyemate.* —— from empyema.
5. —— *mesenterica.* —— mesenteric.
6. —— *a pure aërato.* —— from aërated matter.
7. —— *a phthisi.* —— from consumption.
8. —— *scrophulosa.* —— scrophulous.
9. —— *ischiadica.* —— from ischias.
10. —— *arthropuodica.* —— from joint-evil.
11. —— *a pure contagioso.* —— from contagious matter.
12. —— *variolosa secundaria.* —— secondary of small-pox.
13. —— *carcinomatosa.* —— cancerous.
14. —— *venerea.* —— venereal.
15. —— *a sanie contagiosa.* —— from contagious sanies.

16. *Fe-*

16. *Febris puerpera.* Fever puerperal.
17. —— *a sphacelo.* —— from sphacelus.

GENUS VII.

With Increased Action of the Organs of Sense.

SPECIES.

1. *Delirium febrile.* Delirium of fevers.
2. ——— *maniacale.* ——— maniacal.
3. ——— *ebrietatis.* ——— of drunkenness.
4. *Somnium.* Dreams.
5. *Hallucinatio visûs.* Deception of sight.
6. ——— *auditûs.* ——— of hearing.
7. *Rubor a calore.* Blush from heat.
8. —— *jucunditatis.* —— from joy.
9. *Priapismus amatorius.* Amorous priapism.
10. *Distentio mammularum.* Distention of the nipples.

ORDO II.

Decreased Sensation.

GENUS I.

With Decreased Action of the General System.

SPECIES.

1. *Stultitia insensibilis.* Folly from insensibility.
2. *Tædium vitæ.* Irksomeness of life.
3. *Paresis sensitiva.* Sensitive debility.

GENUS II.

With Decreased Actions of particular Organs.

SPECIES.

1. *Anorexia.* Want of appetite.
2. *Adipsia.* Want of thirst.
3. *Impotentia.* Impotence.
4. *Sterilitas.* Barrenness.
5. *Insensibilitas artuum.* Insensibility of the limbs.
6. *Dysuria insensitiva.* Insensibility of the bladder.
7. *Accumulatio alvina.* Accumulation of fæces.

ORDO III.

Retrograde Sensitive Motions.

GENUS I.

Of Excretory Ducts.

SPECIES.

Motus retrogressus. Retrograde motion.

1. *Mo-*

1.	*Motus ureterum.*	Motion of the ureters.
2.	—— *urethræ.*	—— of the urethra.
3.	—— *ductûs choledoci.*	—— of the bile-duct.

The Orders and Genera of the Third Class of Diseases.

CLASS III.

DISEASES OF VOLITION.

ORDO I.

Increased Volition.

GENERA.

1. With increased actions of the muscles.
2. With increased actions of the organs of sense.

ORDO II.

Decreased Volition.

GENERA.

1. With decreased actions of the muscles.
2. With decreased actions of the organs of sense.

The Orders, Genera, and Species, of the Third Class of Diseases.

CLASS III.

DISEASES OF VOLITION.

ORDO I.

Increased Volition.

GENUS I.

With Increased Actions of the Muscles.

SPECIES.

1.	*Jactitatio.*	Restlessness.
2.	*Tremor febrilis.*	Febrile trembling.
3.	*Clamor.*	Screaming.
4.	*Risus.*	Laughter.
5.	*Convulsio.*	Convulsion.

Con-

	Convulsio debilis.	Convulsion weak.
6.	——— *dolorifica.*	——— painful.
7.	*Epilepsia.*	Epilepsy.
8.	——— *dolorifica.*	——— painful.
9.	*Somnambulismus.*	Sleep-walking.
10.	*Asthma convulsivum.*	Asthma convulsive.
11.	——— *dolorificum.*	——— painful.
12.	*Stridor dentium.*	Gnashing of the teeth.
13.	*Tetanus trismus.*	Cramp of the jaw.
14.	——— *dolorificus.*	——— painful.
15.	*Hydrophobia.*	Dread of water.

GENUS II.

With Increased Actions of the Organs of Sense.

SPECIES.

1.	*Mania mutabilis.*	Mutable madness.
2.	*Studium inane.*	Reverie.
3.	*Vigilia.*	Watchfulness.
4.	*Erotomania.*	Sentimental love.
5.	*Amor sui.*	Vanity.
6.	*Nostalgia.*	Desire of home.
7.	*Spes religiosa.*	Superstitious hope.
8.	*Superbia stemmatis.*	Pride of family.
9.	*Ambitio.*	Ambition.
10.	*Mœror.*	Grief.
11.	*Tædium vitæ.*	Irksomeness of life.
12.	*Desiderium pulchritudinis.*	Loss of beauty.
13.	*Paupertatis timor.*	Fear of poverty.
14.	*Lethi timor.*	—— of death.
15.	*Orci timor.*	—— of hell.
16.	*Satyriasis.*	Lust.
17.	*Ira.*	Anger.
18.	*Rabies.*	Rage.
19.	*Citta.*	Depraved appetite.
20.	*Cacositia.*	Aversion to food.
21.	*Syphilis imaginaria.*	Imaginary pox.
22.	*Psora imaginaria.*	——— itch.

23. *Tabes*

23.	*Tabes imaginaria.*	Imaginary tabes.
24.	*Sympathia aliena.*	Pity.
25.	*Educatio heroica.*	Heroic education.

Ordo II.

Decreased Volition.

GENUS I.

With Decreased Actions of the Muscles.

SPECIES.

1.	*Lassitudo.*	Fatigue.
2.	*Vacillatio senilis.*	See-saw of old age.
3.	*Tremor senilis.*	Tremor of old age.
4.	*Brachiorum paralysis.*	Palsy of the arms.
5.	*Raucedo paralytica.*	Paralytic hoarseness.
6.	*Vesicæ urinariæ paralysis.*	Palsy of the bladder.
7.	*Recti paralysis.*	Palsy of the rectum.
8.	*Paresis voluntaria.*	Voluntary debility.
9.	*Catalepsis.*	Catalepsy.
10.	*Hemiplegia.*	Palsy of one side.
11.	*Paraplegia.*	Palsy of the lower limbs.
12.	*Somnus.*	Sleep.
13.	*Incubus.*	Night-mare.
14.	*Lethargus.*	Lethargy.
15.	*Syncope epileptica.*	Epileptic fainting.
16.	*Apoplexia.*	Apoplexy.
17.	*Mors a frigore.*	Death from cold.

GENUS II.

With Decreased Actions of the Organs of Sense.

SPECIES.

1.	*Recollectionis jactura.*	Loss of recollection.
2.	*Stultitia voluntaria.*	Voluntary folly.
3.	*Credulitas.*	Credulity.

The Orders and Genera of the Fourth Class of Diseases.

CLASS IV.

DISEASES OF ASSOCIATION.

ORDO I.

Increased Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

ORDO II.

Decreased Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

ORDO III.

Retrograde Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

The Orders, Genera, and Species, of the Fourth Class of Diseases.

CLASS IV.

DISEASES OF ASSOCIATION.

ORDO I.

Increased Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Rubor vultûs pransorum.* Flushing of the face after dinner.

2. *Su-*

2. *Sudor stragulis immerso-rum.* Sweat from covering the face in bed.
3. *Cessatio ægritudinis cute excitata.* Cure of sickness by stimulating the skin.
4. *Digestio aucta frigore cutaneo.* Digestion increased by coldness of the skin.
5. *Catarrhus a frigore cutaneo.* Catarrh from cold skin.
6. *Absorptio cellularis aucta vomitu.* Cellular absorption increased by vomiting.
7. *Singultus nephriticus.* Nephritic hiccough.
8. *Febris irritativa.* Irritative fever.

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

1. *Lacrymarum fluxus sympatheticus.* Sympathetic tears.
2. *Sternutatio a lumine.* Sneezing from light.
3. *Dolor dentium a stridore.* Tooth-edge from grating sounds.
4. *Risus sardonicus.* Sardonic smile.
5. *Salivæ fluxus cibo viso.* Flux of saliva at sight of food.
6. *Tensio mammularum viso pueruli.* Tension of the nipples of lactescent women at sight of the child.
7. *Tensio penis in hydrophobia.* Tension of the penis in hydrophobia.
8. *Tenesmus calculosus.* Tenesmus from stone.
9. *Polypus narium ex ascaride.* Polypus of the nose from ascarides.
10. *Crampus surarum in diarrhœa.* Cramp from diarrhœa.
11. *Zona ignea nephritica.* Nephritic shingles.
12. *Eruptio variolarum.* Eruption of small-pox.
13. *Gutta rosea stomatica.* Stomatic rosy drop.
14. ——— *hepatica.* Hepatic rosy drop.
15. *Podagra.* Gout.
16. *Rheumatismus.* Rheumatism.

17. *Ery-*

17. *Erysipelas.* Erysipelas.
18. *Testium tumor in gonorrhœa.* Swelled testes in gonorrhœa.
19. ——— *in parotitide.* ——— in mumps.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

1. *Deglutitio invita.* Involuntary deglutition.
2. *Nictitatio invita.* ——— nictitation.
3. *Risus invitus.* ——— laughter.
4. *Lusus digitorum invitus.* ——— actions with the fingers.
5. *Unguium morsiuncula invita.* ——— biting the nails.
6. *Vigilia invita.* ——— watchfulness.

GENUS IV.

Catenated with External Influences.

SPECIES.

1. *Vita ovi.* Life of an egg.
2. *Vita hiemi-dormientium.* Life of winter-sleepers.
3. *Pullutatio arborum.* Budding of trees.
4. *Orgasmatis venerei periodus.* Periods of venereal desire.
5. *Brachii concussio electrica.* Electric shock through the arm.
6. *Oxygenatio sanguinis.* Oxygenation of the blood.
7. *Humectatio corporis.* Humectation of the bōdy.

ORDO II.

Decreased Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Cutis frigida pransorum.* Chillness after dinner.
2. *Pallor urinæ pransorum.* Pale urine after dinner.
3. ——— *a frigore cutaneo.* ——— from cold skin.
4. *Pallor ex ægritudine.* Paleness from sickness.
5. *Dyspnœa a balneo frigido.* Shortness of breath from cold bathing.

6. *Dys-*

6. *Dyspepsia a pedibus frigidis.* Indigestion from cold feet.
7. *Tussis a pedibus frigidis.* Cough from cold feet.
8. ——— *hepatica.* Liver-cough.
9. ——— *arthritica.* Gout-cough.
10. *Vertigo rotatoria.* Vertigo rotatory.
11. ——— *visualis.* ——— visual.
12. ——— *ebriosa.* ——— inebriate.
13. ——— *febriculosa.* ——— feverish.
14. ——— *cerebrosa.* ——— from the brain.
15. *Murmur aurium vertiginosum.* Noise in the ears.
16. *Tactus, gustus, olfactus vertiginosi.* Vertiginous touch, taste, smell.
17. *Pulsus mollis a vomitione.* Soft pulse in vomiting.
18. ——— *intermittens a ventriculo.* Intermittent pulse from the stomach.
19. *Febris inirritativa.* Inirritative fever.

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

1. *Torpor genæ a dolore dentis.* Coldness of the cheek from tooth-ach.
2. *Stranguria a dolore vesicæ.* Strangury from pain of the bladder.
3. ——— *convulsiva.* Convulsive strangury.
4. *Dolor termini ductûs choledochi.* Pain of the end of the bile-duct.
5. *Dolor pharyngis ab acido gastrico.* Pain of the throat from gastric acid.
6. *Pruritus narium a vermibus.* Itching of the nose from worms.
7. *Cephalæa.* Head-ach.
8. *Hemicrania et otalgia.* Partial head-ach, and ear-ach.
9. *Dolor humeri in hepatitide.* Pain of shoulder in hepatitis.
10. *Torpor pedum variolâ erumpente.* Cold feet in eruption of small-pox.

11. *Testium dolor nephriticus.* Nephritic pain of testes.
12. *Dolor digiti minimi sympatheticus.* Pain of little finger from sympathy.
13. *Dolor brachii in hydrope pectoris.* Pain of the arm in dropsy of the chest.
14. *Diarrhœa a dentitione.* Diarrhœa from toothing.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

1. *Titubatio linguæ.* Impediment of speech.
2. *Chorea Sancti Viti.* St. Vitus's dance.
3. *Risus.* Laughter.
4. *Tremor ex irâ.* Trembling from anger.
5. *Rubor ex irâ.* Redness from anger.
6. ——— *criminati.* Blush of guilt.
7. *Tarditas paralytica.* Slowness from palsy.
8. ——— *senilis.* ——— of age.

GENUS IV.

Catenated with External Influences.

SPECIES.

1. *Somni periodus.* Periods of sleep.
2. *Studii inanis periodus.* ——— of reverie.
3. *Hemicraniæ periodus.* ——— of head-ach.
4. *Epilepsiæ dolorificæ periodus.* ——— of painful epilepsy.
5. *Convulsionis dolorificæ periodus.* ——— of painful convulsion.
6. *Tussis periodicæ periodus.* ——— of periodic cough.
7. *Catameniæ periodus.* ——— of catamenia.
8. *Hæmorrhoidis periodus.* ——— of the piles.
9. *Podagræ periodus.* ——— of the gout.
10. *Erysipelatis periodus.* ——— of erysipelas.
11. *Febrium periodus.* ——— of fevers.

ORDO III.

Retrograde Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Diabetes irritata.* Diabetes from irritation.

2. *Su-*

2. *Sudor frigidus in asthmate.* Cold sweat in asthma.
3. *Diabetes a timore.* Diabetes from fear.
4. *Diarrhœa a timore.* Diarrhœa from fear.
5. *Pallor et tremor a timore.* Paleness and trembling from fear.
6. *Palpitatio cordis a timore.* Palpitation of the heart from fear.
7. *Abortio a timore.* Abortion from fear.
8. *Hysteria a timore.* Hysterics from fear.

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

1. *Nausea idealis.* Nausea from ideas.
2. ——— *a conceptu.* ——— from conception.
3. *Vomitio vertiginosa.* Vomiting from vertigo.
4. ——— *a calculo in ureteré.* ——— from stone in the ureter.
5. ——— *ab insultu paralytico.* ——— from stroke of palsy.
6. ——— *a titillatione faucium.* ——— from tickling the throat.
7. ——— *cute sympathetica.* ——— from sympathy with the skin.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

1. *Ruminatio.* Rumination.
2. *Vomitio voluntaria.* Voluntary vomiting.
3. *Eructatio voluntaria.* ——— eructation.

GENUS IV.

Catenated with External Influences.

SPECIES.

1. *Catarrhus periodicus.* Periodical catarrh.
2. *Tussis periodica.* Periodic cough.
3. *Hysteria a frigore.* Hysterics from cold.
4. *Nausea pluvialis.* Sickness against rain.

[To be continued.]

XLIX. *On that Power of the Eye, by which it is adjusted to see Objects distinctly at different Distances. By* Ez. Walker, *Esq.*

To Mr. Tilloch.

SIR,

Philosophers have varied much in their opinions, for near two hundred years, respecting that power of the eye by which it is adjusted to see objects distinctly at different distances.

Kepler, M. le Cat, and some other philosophers supposed, that when we view distant objects the eye contracts itself and becomes flatted, by which means the distance between the crystalline lens and the retina is decreased; but when near objects are seen, the axis of the eye is lengthened, and this distance is therefore greater. Des Cartes, Dr. Pemberton, and Dr. Young, have adopted the opinion that the form of the crystalline lens alters with the distance of the object from the eye. Dr. Porterfield thinks, that the adjustment of the eye is produced by an alteration in the curvature of the cornea and a motion of the crystalline lens. De la Hire imagined, that the eye undergoes no change, except the contraction and dilatation of the pupil. Mr. Ramsden and Mr. Home conclude from their experiments, that the adjustment is produced by three changes in the eye; a motion in the crystalline lens, an elongation of the axis of vision, and an increase of curvature in the cornea. Haller, Smith, Jurin, Monro, and many others, have also written upon this subject. But as none of the hypotheses hitherto advanced have been demonstrated, either by decisive experiments or from the known laws of dioptrics, this property of vision seems still to remain in much obscurity.

On entering upon an inquiry of this nature, it will be necessary to reject all suppositions that are not conformable to those beautiful mechanical laws which are seen in every other part of the animal œconomy. I cannot therefore suppose that the whole globe of the eye alters its form

every

every time we view objects at different distances. Nor does it appear probable that the power of adjustment lies either in the vitreous humour or in the crystalline lens, for they are too dense to admit of that infinite variety of changes which the eye undergoes every day.

As the crystalline lens alone is sufficient to form a distinct image of an object upon the retina, it is therefore very reasonable to suppose that the aqueous and the vitreous humours are designed for other purposes than merely to act as refracting mediums.

The vitreous humour is a dense transparent substance, which seems designed by nature to preserve the lenticular form of the crystalline, and to keep it at the same distance from the retina; for the crystalline lens is so deeply imbedded in the vitreous humour, and adheres so closely to it, that the crystalline cannot suffer any change in its form, without giving motion to some part of the vitreous.

Now, as nature performs all her mechanical operations by the most perfect mechanical laws, it must appear improbable, from the density of these substances, that any change should take place, either in the figure of the crystalline lens or in its distance from the retina.

Just before the crystalline lens the iris is placed. The use of this organ is to contract and enlarge the pupil; and as it is put in motion by almost every ray of light that falls upon the cornea, it seems necessary for its preservation that it should meet with the least resistance possible; therefore it swims in a limpid fluid called the aqueous humour.

The contraction of the pupil answers two important purposes; one to exclude too great a quantity of light, which would be injurious to the eye, and the other to give us a distinct view of near objects. But how a contracted pupil should produce this effect may be explained from the following property of vision, viz.—

That we have no vision perfectly distinct, but by rays which enter the eye in a direction parallel to the axis of the crystalline lens.

This will be easily understood from the following observations:

First Observation.

If we look attentively at a remote object, which subtends a very small angle at the eye, that object will be seen more distinctly than any other object that may be near it; because those rays that enter the eye near the axis of vision are so nearly parallel, on account of the great distance of the object, that the eye can distinguish no difference between these and parallel rays; and those rays passing through the crystalline lens, near its axis, and falling perpendicularly upon the retina, produce vision as perfect as the distance and magnitude of the object will admit. But those rays which form an angle with the visual axis fall obliquely upon the retina, and produce indistinct vision.

Second Observation.

If we look at a near and small object with attention, the pupil will contract so as to admit only those rays that are nearly parallel to the axis of vision. Suppose, for example, that we look at the point on the letter *i* in a printed book, the remaining part of the letter, and all the surrounding letters, will be seen imperfectly, for the same reason that was given above.

Third Observation.

Let the same object (·) be brought within two inches of the eye, and it will appear indistinct, because the rays issuing from it will enter the eye in a diverging state, in consequence of the pupil's being too large for the object. But if the pupil be contracted by means of a perforation about $\frac{1}{30}$ of an inch in diameter, placed before the eye, made either in a thin piece of metal or a slip of paper, the object will be seen distinctly, because no rays will then enter the eye, except those that are nearly parallel to the axis of vision.

Hence it is evident, that we have no perfect vision, but by rays which enter the eye in a direction parallel to the axis of the crystalline lens, and fall perpendicularly upon the retina; and as all rays that fall upon a convex lens parallel to its axis are converged to the same point, the following conclusion must be strictly true, viz.

When

When an object is seen distinctly, its image is painted at the same invariable distance from the crystalline lens, whether the object be near or remote.

The same Property of Vision demonstrated by Experiments.

It is a property of the convex lens, that when its aperture is contracted, the image of a near object is painted at the same distance from the glass, as a remote one when its aperture is enlarged.

The instrument with which I made the following experiments consists of two large tubes, one within the other, like the tubes of a telescope. At the end of the large tube a double convex lens of 24 inches focus is fixed to represent the crystalline lens; and the other end of the instrument contains a piece of ground glass, 4½ inches in diameter, polished on one side, to represent the retina. This instrument, being fixed upon a proper stand, was carried into a room and placed at about five feet from a window from which I had an extensive view.

First Experiment.

After I had contracted the object glass to two inches, I drew out the inner tube until the picture of remote objects was distinctly painted upon the rough glass, but near objects were represented imperfectly.

Second Experiment.

When I had contracted the aperture of the lens to half an inch, near objects were represented very distinctly, but the picture of remote objects was less conspicuous.

Third Experiment.

The aperture of the lens being further contracted to $\frac{1}{7}$ of an inch in diameter, all outward objects appeared indistinct; but a plumb-line, which hung down the middle of the window, was clearly represented upon the artificial retina. This line was not seen upon the retina in the first experiment, and only like an enlarged shadow in the second. The distance between the glasses was the same in all the experi-

ments, and no alteration whatever was made in the instrument, except in the aperture of the lens.

Whence it is evident, that a large pupil gives us a distinct view of remote objects; that a contracted pupil gives us a clear view of near objects; and that no part of the eye, except the iris, suffers any change in making these adjustments.

The same Property of Vision demonstrated by a more simple Experiment.

Let a remote object be observed through an aperture of about $\frac{1}{50}$ of an inch in diameter, made in the manner already mentioned, and if the object be seen in a proper light it will appear as distinct as to the naked eye. Then introduce a pin, or any other small object, in a line between the remote object and the eye, at the distance of five or six inches from it, and these two objects will appear as distinct when seen together as when they are viewed separately; but the moment the aperture is taken away from before the eye, the near object will be seen very indistinctly; and as the aperture may be removed so instantaneously as to render it impossible for any change to take place in the internal parts of the eye, it is therefore evident, that the iris is the only organ by which the eye is adjusted to distinct vision.

Hence it is as clearly proved as any proposition in optics, that the rays issuing from a near object, after having passed through a small aperture, are conveyed to the same point upon the retina as those from a remote one; the rays from both objects being nearly parallel.

These experiments also prove, that an eye which has lost the crystalline lens, if the iris has not received any injury, may still retain its power of adjustment.

I am, sir,

Your humble servant,

Lynn,
6th Jan. 1808.

Ez. Walker.

L. *On the Stanhope and other Temperaments of the Musical Scale. By Mr.* JOHN FAREY.

To Mr. Tilloch.

SIR,

THE Table of Musical Intervals which you have done me the favour to engrave for your 112th number, (vol. xxviii. p. 143,) after I had left Town, and could not therefore attend to the proof which the engraver obligingly sent me, unfortunately contains three errors, which I beg here to correct, viz. the *minor* THIRD should be 161 Σ &c., instead of 191. The numerator of the ratio of the DIEZE *minimum* should be 19,683, instead of 16,983; and that of the COMMA *and* HALF should be 1953 instead of 1593. At page 142, vol. xxviii., the temperament or difference of the *equal temperament* V, from the Diatonic V, should also be corrected and made $-\Sigma - \frac{1}{17}\,\mathrm{m}$, instead of $-1\frac{1}{2}\,\Sigma - \frac{1}{17}\,\mathrm{m}$.

Such of your readers as are in the habit of attending at the Royal Institution, and of noticing the pamphlets on their library tables, can scarcely be unacquainted, and it is perhaps proper that your readers in general should be informed, that in the beginning of July last, a pamphlet entitled "*Plain Statement of Earl Stanhope's Temperament, by Dr. Callcott,*" was exhibited for sale, for a day or two, in the shops of Mr. Birchall, Mr. Byfield, and perhaps of others, and then disappeared therefrom, in consequence, as I have been told, either of a *legal* interposition or the threat of such, both against that pamphlet, and the one which you did Dr. Callcott and me the favour to reprint, at p. 143 of your last volume; and that a great number of copies of *another* "Plain Statement of Earl Stanhope's Temperament, by Dr. Callcott," printed some weeks prior to that offered for sale as above mentioned, have since been stitched up with the "Plain Statement" and "Letter to the Duke of Cumberland" above mentioned, (which two are said to have been printed under Lord Stanhope's directions.) and these three pamphlets in one cover, were, and I believe still continue to be, privately circulated. The reason for which extraordinary

proceedings I did expect (when I left Town in August last) would quickly appear to the public, from the proof of the first sheet of a printed *Narrative* of transactions, between certain persons relative to the *Stanhope Temperament*, which was shown to me at the Institution; and as this "Narrative" promised to throw some additional light upon the Letter to the Duke of Cumberland, relating to me, (vol. xxviii. p. 143,) I abstained from replying thereto before I went out of Town. Since my return, which was but a short time before Christmas, I have not been able to learn anything concerning the progress of the "Narrative," but hear, that the public may very shortly expect some further remarks from his Lordship on his Temperament, and which it were much to be wished (for the interests of science) that his Lordship would communicate through the medium of your Magazine. On these accounts, I shall further defer my observations on his Lordship's Letter, and on the merits or defects of his system, since the appeal to mathematical writings and truths which I meditate, may perhaps apply at once to the whole of his Lordship's case, if he really has anything further to advance, and save me and your readers much trouble: in the mean time, as a great part of his Lordship's Plain Statement is made to turn on a comparison of his system with three others, viz. the *Isotonic* or equal temperament, *M. Prinz's* system, and that of *M. Kirnberger*, I beg to present your readers with the notes of these three systems, expressed in the small intervals Σ, f and m, as has been done for his Lordship's system, in my table, vol. xxviii. p. 141, column 6.

A Table

A Table of the Relations which the several Notes in an Octave bear to the fundamental Note C, *when tuned according to three different Systems of Temperament.*

1.	2.	3.	4.	5.	6.
12	c	VIII	612 Σ + 12 f + 53 m	612 Σ + 12 f + 53 m	612 Σ + 12 f + 53 m
11	B	VII	561 Σ + 11 f + 48 $\frac{7}{12}$ m	555 Σ + 11 f + 48 m	555 Σ + 11 f + 48 m
10	bB	7th	510 Σ + 10 f + 44 $\frac{1}{6}$ m	508 Σ + 10 f + 44 m	508 Σ + 10 f + 44 m
9	A	VI	459 Σ + 9 f + 39 $\frac{3}{4}$ m	453 $\frac{3}{4}$ Σ + 9 f + 39 $\frac{1}{4}$ m	456 $\frac{1}{2}$ Σ + 9 f + 39 $\frac{1}{2}$ m
8	bA	6th	408 Σ + 8 f + 35 $\frac{1}{3}$ m	404 Σ + 8 f + 35 m	404 Σ + 8 f + 35 m
7	G	V	357 Σ + 7 f + 30 $\frac{11}{12}$ m	355 $\frac{1}{2}$ Σ + 7 f + 30 $\frac{3}{4}$ m	358 Σ + 7 f + 31 m
6	bG	IV	306 Σ + 6 f + 26 $\frac{1}{3}$ m	300 Σ + 6 f + 26 m	301 Σ + 6 f + 26 m
5	F	4th	255 Σ + 5 f + 22 $\frac{1}{12}$ m	254 Σ + 5 f + 22 m	254 Σ + 5 f + 22 m
4	E	III	204 Σ + 4 f + 17 $\frac{2}{3}$ m	197 Σ + 4 f + 17 m	197 Σ + 4 f + 17 m
3	bE	3d	153 Σ + 3 f + 13 $\frac{1}{4}$ m	150 Σ + 3 f + 13 m	150 Σ + 3 f + 13 m
2	D	II	102 Σ + 2 f + 8 $\frac{5}{6}$ m	98 $\frac{1}{2}$ Σ + 2 f + 8 $\frac{1}{2}$ m	104 Σ + 2 f + 9 m
1	bD	2d	51 Σ + f + 4 $\frac{7}{12}$ m	46 Σ + f + 4 m	46 Σ + f + 4 m
	C	Key			
Intervals in half notes.	Letters.	Marks.	Isotonic System.	M. Prinz's System.	M. Kirnberger's System.

In

In column 4 of the preceding table, the 2nd ($=51\,\Sigma + f + 4\frac{5}{7}\,m$) will be found to be the difference or interval between each adjoining note, and consequently every 3rd, III, 4th, V, 6th or VI, as well as VIII in this system are equal, in whatever part of the scale the same are taken; and if VIII ($612\,\Sigma + 12\,f + 53\,m$) be added to the 2nd, II, 3rd, III, &c., in order to obtain a second octave above the one in the table, this will at once appear, by subtracting the value of any note from the value of another, situate the proper number of half-notes above it.

A superior octave being in like manner supplied to each of the other systems, in columns 5 and 6, and column 6, vol. xxviii. p. 141, if the 12 several *minor thirds* (3rds) in each system be taken out, and if the difference between each of these and a true or perfect 3rd ($161\,\Sigma + 3\,f + 14\,m$) be found and placed in order in a table, with the sign + to every *sharp* temperament or interval larger than a 3rd, and the sign — to every *flat* temperament or interval smaller than a true 3rd, then these several *temperaments* will be found very unequal among themselves, except in the *Isotonic* (where each is $8\,\Sigma + \frac{3}{4}\,m$); but on adding up the whole of them, paying proper attention to the signs + and —, it will be found, that the sum of the temperaments of all the 3rds, in each system, is $96\,\Sigma + 9\,m$, or 3 *Semitones minimum*, as mentioned in my engraved table, vol. xxviii. In like manner, if all the *major thirds* (III) in each of the four systems be taken out, and their temperaments or imperfections (or difference from $197\,\Sigma + 4\,f + 17\,m$) are found, the sum of all these will in each system be found equal to $84\,\Sigma + 8\,m$, or 4 *Enharmonic Diesis;* also if all the temperaments of the 4ths, (or differences from $254\,\Sigma + 5\,f + 22\,m$) be summed up, they will in each system amount to $12\,\Sigma + m$, or the *Diaschisma:* the sum of the temperaments of the Vths (or differences from $353\,\Sigma + 7\,f + 31\,m$) will be found $12\,\Sigma + m$; of the 6ths (or differences from $455\,\Sigma + 8\,f + 36\,m$) $84\,\Sigma + 8\,m$; and of the VIIths (or differences from $451\,\Sigma + 9\,f + 39\,m$) $96\,\Sigma + 9\,m$, as mentioned in the engraved table above referred to.

With such tables as these before us, calculated for each and every

every system, between which and his own Lord Stanhope has drawn or may draw a comparison, referring also to the number of *beats* made per 1″ by each tempered conchord, throughout the whole scale, we shall ultimately be able to bring his Lordship's loud pretensions to pre-eminence over every other system, to a more scientific and competent test, than the *opinion* of 60 or 70 *anonymous persons*, who heard an instrument played upon, which, Lord Stanhope says, (vol. xxv. p. 306) was tuned according to his system. See Monthly Magazine, vol. xxii. p. 114.

I am, sir, yours, &c.

JOHN FAREY.

12, Upper Crown-Street, Westminster,
January 15, 1808.

LI. *Report of Surgical Cases in the City and Finsbury Dispensaries for August* 1807. *By* JOHN TAUNTON, *Esq.*

IN the month of August there were admitted on the books of the City and Finsbury Dispensaries 188 surgical patients.

Cured or relieved - -	171
Died - - - -	1
Under cure - - -	16
	188

Mrs. A. C. æt. 53, of a thin spare habit of body and of a very delicate constitution, has been afflicted with hernia in the left thigh upwards of 20 years: it first appeared subsequent to a difficult labour, and was much aggravated by a second labour about two years afterwards: she suffered much from carrying heavy burthens, and was frequently confined to the house for some days. For about the first eight years it could be easily returned by placing the body in a horizontal position; but from that time it has been irreducible, and occasionally attended with great pain, sickness, vomiting, and constipation of the bowels; for which, however, she had not any surgical assistance till the present attack, which

which took place on Monday August 24th, when she was seized with violent pain and tension of the abdomen similar to labour pains. The neighbours gave her the usual carminatives; but the pain increased, the tumour enlarged, vomiting, hiccup, and cold sweats came on; she was worse on the 25th, and was delirious at night. On the 26th in the morning an aperient medicine was given, but that was immediately rejected on its being received into the stomach. At four o'clock in the afternoon an enema was injected, but that also returned immediately without any feculent matter. On the 27th she was much worse during the whole day, feculent matter being vomited in large quantities. I saw her for the first time at nine o'clock in the evening, when the pulse was scarcely perceptible, the extremities cold, the eyes had a peculiar wild stare, and the body was partially covered with a profuse cold sweat: she appeared to be nearly in articulo mortis. Having explained the extreme danger of the case to the patient and to her husband, she expressed her desire of having the operation immediately performed. The hernia was situated under Poupart's ligament, on the inner side of the large blood-vessels (the usual seat of crural or femoral hernia). An incision of about three inches in length was made through the integuments along the middle of the tumour, beginning at the inferior edge of Poupart's ligament. The fascia was thin, and very little adipose substance intervened between the integuments and hernial sac; which last was also extremely thin, but did not contain any fluid, and adhered to the omentum, which was much discoloured and compressed, the circulation having ceased in every part of it. It was then removed by excision close to the mouth of the sac, the edges of the integuments were supported in contact, by two sutures and some straps of adhesive plaster. The patient lay perfectly quiet during the operation, from which she did not express any sensation of pain. Two spoonfuls of an aperient medicine were then given, which remained on the stomach. She was quiet during the night, but did not sleep.

28th. There had not been any pain or sickness since the operation, the pulse was somewhat more distinct, but the extremities remained cold. The aperient medicine was repeated, and

and succeeded by a copious evacuation by stool. The hiccup and vomiting returned in the evening for a short time; after which she slept well, and was much recovered in the morning, when she took some breakfast with an appetite. September the 1st the wound was dressed, which had nearly healed by the first intention; she appeared to be gaining health and strength rapidly, and was completely recovered by the 10th.

In the course of the year 1807, 1419 surgical patients have been admitted on the books of the City Dispensary.

Cured or relieved -	1139
Died - - -	15
Remain under treatment	265
	1419

The estimated expense, including drugs, salaries, house-rent, taxes, &c., attending the treatment of the above 1419 patients, does not exceed 247*l.* 10*s.* !

JOHN TAUNTON,
Surgeon to the City and Finsbury Dispensaries, Lecturer on Anatomy, Surgery, Physiology, &c.

Greville-street, Hatton-garden,
January 23, 1808.

LII. *On the Means of gaining Power in Mechanics.*

To Mr. Tilloch.

SIR,

AMONG the mathematicians of every age much labour and time have been employed to discover *the means of gaining mechanical power*; and even in these enlightened times, although numerous individuals of distinguished talents and reputation persist in asserting the impossibility of gaining such power, the contrary opinion is, notwithstanding, cherished and acted upon by as many, perhaps, of equal genius and science. Yet, inconsistent as it may appear, the result of the experiments and practice during more than 2000 years, is, that principles and maxims have gradually been established utterly discouraging every hope of success in the pursuit.

This

This variance of opinion among those who may fairly be presumed the best informed and most intelligent, respecting a very simple mathematical question, (as it may be hereafter proved,) implies, or rather makes it evident, that doubts have been, and are still, entertained of the infallibility of the admitted principles; and there is reason to suspect, that to the influence these have had on the generality of mathematicians and mechanics, may be imputed the disappointments experienced in many of their attempts, which might else have succeeded: for it is remarked, that the world is mostly indebted for discoveries and inventions to illiterate men, whose genius was not checked or restrained, like that of the learned, by rules and maxims, beyond which they never dare or deign to look.

As a mere private gentleman, having but a very superficial knowledge of mechanics, in which I occasionally amuse myself with experiments, my taking ground on either side is quite out of the question; but I am going to state a fact which cannot be controverted, and which, in addition to the instance of Œffyreus's wheel, seems to justify those who are seeking the perpetual motion.

I have constructed an engine, rather simple than complicate, which produces the following effect:

On applying my moving power, a weight of *two pounds—while this descends through a space of only three feet, a weight of twenty pounds is thereby raised two feet perpendicular* *.

Some friends and acquaintances to whom this circumstance was mentioned, were either incredulous, or suspected my being deceived in the operation of the machine, or mistaken in some other way. But the operation is so very simple that I cannot be mistaken or deceived; for the engine stands perfectly motionless, or at rest, until the moving power of two pounds is applied to it, in opposition to the twenty pounds weight which is hung on to be raised; whereupon this last immediately rises in the time that the former

* That moving power also raises another considerable weight to a small height *at and in the same time*; but the single stated fact will suffice for present consideration.

descends,

descends, as before described; and this experiment has daily been repeated and verified for some months past.

I therefore at length venture, with all deference, to announce this plain and indisputable fact, and to submit it to the consideration and comments of the scientific among the numerous readers of the Philosophical Magazine; and shall be grateful to those gentlemen who will take the trouble to inform me, through the same medium, whether anything similar has been produced; and favour me with their observation upon, and candid opinion of, this presumed novelty, *the possibility of which cannot be admitted consistently with the present theory of mechanics.*

I shall probably have further important communications to make on this subject in the next Philosophical Magazine.

B——, E. V.
January 20, 1803.

LIII. *On destroying Insects injurious to Cultivation.*

To Mr. Tilloch.

DEAR SIR,

Among all the casualties to which vegetable life is exposed, nothing seems so destructive or difficult to be obviated, as the effects of predatory insects. There is probably an infinite variety of vermin, particularly in greenhouses, stoves, and similar contrivances to force vegetation; which, in the shape of flies, caterpillars, worms, or grubs, are constantly blasting the hopes of the cultivator. I believe, however, it has been clearly ascertained, that the most prevailing and obnoxious of all these enemies is the plant-louse, the *aphis* of Linnæus; a genus perhaps the most numerous of the whole system, for every kind of vegetable has, it is said, a species of this insect, to whose ravages it is peculiarly liable: and another circumstance tends materially to confirm the mischief, when it has once begun, for, according to the general opinion of naturalists, these pernicious animals multiply with astonishing rapidity and certainty, wherever they intrude; and from their

structure, and general œconomy, they are amply provided for spreading destruction.

It must give great satisfaction to those who practise or patronize horticulture, to be informed of a very simple cure, which has proved invariably successful, and is neither costly nor difficult to be obtained—it is the mere application of *sulphur*, but not burned by way of fumigation or smoke. The precise method of using it has not yet been detailed to me; when it is, you may expect to receive all necessary instructions: in the mean time let it be observed, that the sublimed sulphur, the *flores sulphuris*, not the crude brimstone in powder, is what has been employed.

Having received my information from the most respectable source, it becomes me to disclaim all pretension to the merit of the discovery; I shall, therefore, add, that it was in the extensive and highly cultivated gardens of the hon. baron Hepburn, in East Lothian, where the first experiments were made; and, I understand, both there and in other gardens, the practice has been constantly attended with success.

I remain, dear sir,
your obliged and obedient servant,
JOS. HUME.

Long-Acre,
Jan. 22, 1808.

LIV. *Notices respecting New Books.*

Encyclopædische Uebersicht der Wissenschaften des Orients, aus sieben Arabischen, Persischen, und Türkischen Werken uebersetzt: den Freunden und Kennern der Orientalischen Litteratur gewidmet von einem derselben Beflissenen in Konstantinopel.—"Cyclopedical View of the Sciences of the East, translated from seven Works, in Arabic, Persian, and Turkish: inscribed to those who are acquainted with Oriental Literature, by a Person residing at Constantinople."—Leipsick, 1804, 8vo, 2 parts, pp. 699.

HOWEVER useful to the advancement of Oriental learning, or however necessary for completing the history of the human mind

mind it might be, were we in possession of a good literary history of the Arabs, Persians, and Turks, there has been no work of this description yet attempted, from the insurmountable difficulties hitherto attending its execution. These difficulties do not arise from the three Eastern nations alluded to having neglected to transmit to posterity the history of those of their countrymen who have cultivated the various branches of science and literature. It is rather the abundance of the books of this description they have composed, than the want of materials, which has been the obstacle to the execution of a literary history of the East. Grammarians, interpreters and lecturers upon the Alcoran, theologians of all classes, doctors and jurisconsults of all sects, philosophers, physicians, historians, prose-writers, poets ;—in short, from the immediate companions of the Prophet down to those who in the last century were the honour of Turkish literature, all have found their historians, as well as the khalifs, the sultans, and their ministers. Besides all this, we have histories of celebrated men of all kinds, of each of the principal cities in the country of the Mussulmen, such as Mecca, Medina, Sanaa, Damas, Bagdad, Cairo, &c. We may add, that in most of the annals composed by the Arab historians, such as Ebn-Athir, Aboulfeda, Makrizi, Aboulmahasen and others, we find, after the recital of the political events of each year, a necrological article, containing the names of all the celebrated men who died in the course of the year, with more or less detailed accounts of their lives and writings. With these materials, however, for composing a literary history of the Eastern countries, there is a multitude of difficulties to be removed before we can render our materials of any service.

The literary history of a nation may be divided into two principal parts : the history of letters and sciences, and that of the persons who have cultivated them. The first ought to make us acquainted with the commencement, and the various revolutions, of each science or particular branch of literature, and the causes which have concurred to accelerate or retard its progress. It is the *systematic* part of literary

history, in which those who have acquired celebrity in learning or science by their labours, their discoveries, or their errors, appear by turns upon the stage, but merely as an accessory part of the picture, and without drawing off the attention from the principal object to fix it upon each of them in particular. The second part of literary history, which may be called biographical, is composed of the particular histories of those who have contributed, either by their own labours or by their influence and benefactions, to the cultivation and advancement of human knowledge. Each of them here appears isolated, in order to make us acquainted with the time, place, and circumstances in which he lived, the means of instruction which nature or fortune presented to him, the application he made of them, the labours for which posterity is indebted to him, the services he rendered, the monuments he has bequeathed of his talents and zeal. According to the importance of the part which each of them has performed, he occupies in this kind of historic gallery a space more or less considerable; but no person whose literary or scientific career has been marked by any service rendered, or any work left to posterity, should be omitted. Thus the principal cities, the seats of administration, or the places illustrated by any great events, have claims to a place in the general chart of a great empire; and when it is requisite to draw a map of a province, the smallest cottage, which contributes its share to the support of the charges of the state, cannot be omitted without injustice.

The biographical part of literary history is, properly speaking, the only one with which the Orientalists are occupied; and it is only by comparing and classifying the abundant materials of this kind which they have left us, that we can afterwards extract what is necessary for composing the systematic part neglected by them. It is therefore with biographical history exclusively we must commence: but even here the task is not easy; it requires great opportunities, time, and discernment, and the concurrence of several, as the following observations will convince us.

In the first place, all the materials for a labour of this kind are in manuscript, and consequently they require much

much critical skill, and a knowledge far from superficial of the languages in which they are written.

Secondly, it is impossible to unite all these materials;—the number of booksellers who possess them is not very considerable, and but a small part of them falls to the lot of each. Some even of the most essential documents do not appear to have as yet arrived in Europe, or are altogether unknown.

Thirdly, the Orientalists having but a small number of proper names, the same name, Abdallah, for example, or Mahomed, Ali, Hassan, Hosain, &c., is necessarily common to a very great number of men. In order to remedy the confusion which would result from this homonymy, there is added to the name of each, 1st, a surname (conya) taken from the name of his eldest son, as Abou-Mahomed, Aboul-Hassan, (father of Mahomed, father of Hassan): 2d, the name of his father, and frequently that of his grandfather: 3d, a surname taken from the place where he was born, or where he lived, as Ispahani, Baconi, Bagdadi, &c.: 4th, an honorary title (lakab)—this is peculiar to the cadis, or their assessors, the imans, the sheiks, the doctors, and monks—such as Boha-eddin, (the splendour of religion,) Djelal-eddin, (the glory of religion,) Tadj eddin, (the crown of religion.) In the order of these names and surnames, the honorary title is generally first; then comes the surname (conya) properly so called, then the name followed by that of the father and grandfather, and lastly, the surname taken from the place of birth: sometimes the same person bears several names of this last description. Thus, in order to designate completely the celebrated physician Abd-allatif, the author of a great number of works, he is thus described: Mouwaffik-eddin Abou-Mahomed Abd-allatif Ben Yousoff Mauseli Bagdadi. Mouwaffik-eddin (the protector of religion) is his honorary title; Abou-Mahomed (father of Mahomet) is his surname, taken from the name of his eldest son; Abd-allatif is his own name; Ben Yousoff, (son of Yousoff.) the surname taken from the name of his father; Mauseli, from Mosul, Bagdadi, frrom Bagdad, are

surnames, which intimate that his family was originally from Mosul, but that he was born at Bagdad. Many individuals have, besides, certain nicknames, or surnames taken from some illustrious ancestor, or circumstance of their life. This multitude of names and surnames contributes in several ways to throw much confusion upon literary history, and chiefly because they rarely designate a person by the whole of these names, and the same individual is sometimes called by his honorary title only, as Djelal-eddin, or by his name without any surname, as Abd-allatif, or by the name of his son, as Aboulabbas, (the father of Abbas,) or by that of his father, as Ebn-Arabschah, (the son of Arabschah,) or lastly, by the surname taken from the place of his birth, as Djordjani, Schahrestani, Soyouti. We may be often led into error, therefore, by supposing several personages to be one only, and *vice versâ*. In the second place, the copyists, by omitting the words Abou, (father,) or Ebn, (son,) or confounding together these two words, often call Abd-allah, or Abd-alrahman, the person who is really called father or son of Abd-allah, or Abd-alrahman. Lastly, there is so great a number of celebrated men, whom we are accustomed to know merely by one of their surnames, that the Oriental biographers themselves can neither discover their names or surnames. There are none of the learned who are occupied with the literature of the East, without excepting Herbelot and Caziri, who have not been often led into error from some of these causes. The titles of books being also almost always conceived in an indistinct manner, and several works of various writers having either the same or very similar titles, this is also a new source of mistakes, from which the Eastern historians themselves have not always been exempt.

From all these considerations, it is evident, we are not yet competent to the task of a general history of the literature and science of the Arabs, Persians, and Turks; and we must begin by clearing away this chaos, and by putting the materials into the hands of a greater number of persons, by publishing successively, either entire or in extracts, the most important works of this kind. It is also to be wished,

that

that no occasion should be neglected of giving detached notices upon the most celebrated writers; and by pointing out their names and writings, we should employ all the means furnished by criticism, in order to present with the greatest possible exactness, and in original characters, the entire name of the authors, and titles of their works.

The most important books of this description, and those which would furnish the greatest number of articles for literary history, are:

The *Kitab Alfihrist*, by Aboul-faradji Mohamed Ben-Ishak, better known by the name of Ebn-Abi-Yacoub Nedim: it is a catalogue of Arabian authors and their works, for the three first centuries of the Hegira and a part of the fourth.

The *Wafyat Alayan*, or dictionary of illustrious men, by Ebn-Khilcan.

The *Tarikh Alislam*, by Dhéhébi.

The *Menhal Alsapi*, another dictionary of the same kind, composed by Aboulmahassen, forming a continuation of the preceding.

The *Kitab Almokadhara*, an abridged history of Egypt, by Soyouti, which contains a very useful catalogue of celebrated men who have been born or lived in that country.

The *Kitab Caschf Aldhonoun*, or library of Arabian, Persian, and Turkish books, by Hadji Khalfa.

This last work, of which Herbelot has already made so great use, is the same from which the author of the Cyclopedical View of the Sciences of the East has extracted the greatest part of the materials he has collected in the volume now before us; but he has also laid under contribution six other works, four of which are written in Arabic, one in Persian, and one in Turkish.

The author explains, in the preface, the plan according to which he has arranged the extracts from these various works. The last six have merely served to supply the desiderata in the general picture of the sciences of the East by Hadji Khalfa. Sometimes the extracts of several of these works have been blended together; but oftener he has contented himself with abridging them, indicating the source of each in

particular, and leaving to his readers the care of comparing and combining them. This arrangement is disadvantageous to the author, and favourable to the critic, who may thus compare more easily each of these extracts or abridged translations with the originals, and thus ascertain and rectify the errors which may have escaped the translator.

Frequently, persons who devote their attention to one branch of literature, and who have wasted much time and labour in acquiring profound knowledge, contract a kind of enthusiastic love for the object of their studies, which sometimes appears excessive to readers who judge with greater coolness. The author of the work now before us does not appear altogether free from this weakness; and there are few who will consent to allow Hadji Khalfa the epithets bestowed upon him by our anonymous author, of the triple Hermes of the literature of the East, the Bacon, the Meusel of the Arabs, Persians, and Turks. We may, however, excuse this exaggeration in a man of letters, who has had courage enough to undertake a dry and painful task; and we ought to remember, that, without this enthusiasm, the most of those works which have extended our knowledge, and placed the study of the sciences and literature in the flourishing state they now are, would never have existed.

We find, immediately after the preface, the Life of Hadji Khalfa, whose name is Mustafa, the son of Abd-allah; his surname, Hadji Khalfa, is composed of two Arabian words, *Hadji* (pilgrim), and *Khalifa*, or, as the Turks write and pronounce it, *Khalfa* or *Kalfa* (assessor): he takes the name of Hadji from having accomplished the pilgrimage to Mecca in the year 1043 of the Hegira, (A. D. 1633,) and he added Khalfa to it when he obtained the place of second assessor in the office of Basch-mohæsebe, or chief of the accounts. He was also known by the name of Catib Tchelebi. His father had filled the place of secretary to the Porte, which produced him the name of Catib, and his son inherited it from him: Tchelebi is a Turkish word signifying a man of genteel birth.

This Life of Hadji Khalfa, written by himself, was printed with his *Chronological Tables*, a work of which there is an

Italian translation published at Venice in 1697, and a Latin translation in manuscript by the celebrated Reiske. The Turkish editor of these Chronological Tables has finished the Life of Hadji Khalfa, which the latter had added to one of his works, entitled *Mizan-Alhakk*, i. e. *The Balance of* Truth. It shows us Hadji Khalfa consecrating the greatest part of his life to study or teaching, neglecting no method of increasing his knowledge, and voluntarily renouncing the pleasures and illusions of ambition, in order to amass, in tranquillity, the materials for a great number of useful works, with which he has successively enriched the literature of his country. He finished his mortal career in the year 1068 of the Hegira (A. D. 1657). We are ignorant how old he was, the year of his birth not being mentioned; but it is probable that he was not 60, since he was appointed to the situation of adjunct or commissary in the office of accounts for Natolia, being the first he filled, in the year 1032.

To the Life of Hadji Khalfa, in itself a precious relic of literary history, succeed short notices of the seven original works, the extracts from which compose the work before us; and after all, a tale in the form of a dialogue, extracted from the last of these works; but the original Arabic has for its author, according to report, Imam Gayali.

The interlocutors engaged in this dialogue are, a young Arab named Beschir, and a young Persian named Schadan, and their conversation takes place in presence of the khalif Haroun Raschid, who arrives at the moment these two young people, both strangers, meet, and imbibe a marvellous sympathy for each other. The khalif, after having received their salutations and politely answered them, struck with the vivacity of their looks, addresses himself to Beschir, and asks him whence he came, and how old he is. Beschir answers him in a sententious and ænigmatical manner. To the question put by Haroun, "*Combien d'années avez-vous ?*" (How old are you?) "*Aucunes.*" (None) he answered: the years are in the hands of God! How many do you count, then? I count, said the Arab, from one

up

up to 100,000. In what manner, said the khalif with emotion, must I interrogate you in order to obtain a rational answer? Ask me, said Beschir, how much time of my life has gone past. The khalif puts this question to him, and receives for answer, Fourteen years. He then leaves the two young philosophers to themselves.'

Schadan earnestly entreats Beschir to enter into conversation with him, and to place him among the number of his friends; but Beschir, who does not seem inclined to receive as friends any who could not by their talents or wisdom contribute to the improvement of his mind and heart, subjects Schadan to a rigorous examination, from which the latter does not shrink: "for you know," says he to Beschir, "what the Arab proverb says: Amid the flying sand of the Desert, we can easily distinguish a man on horseback from him who is mounted on an ass."

The questions put by Beschir to Schadan turn upon subjects of dogmatic theology, the interpretation of the Alcoran, grammar, etymology, poetics, æsthetics, gnomics, lexicology, scriptures, jurisprudence, traditional theology, medicine and morals; and the answers of Schadan leave him nothing to desire. The two young people then embrace, and swear a sincere friendship. The khalif, who had overheard their whole conversation, can scarcely believe his ears. All the readers of this work will not partake in this enthusiasm, perhaps, upon hearing that Beschir proposes questions of the following nature: What is the Arab word, which, without any change of letters, can be a verb, noun, and participle? Why do walnuts eaten before dinner lock up the bowels, and when taken after dinner produce a contrary effect? Why is a certain word in the Alcoran a nominative?

We must admire the answers of Schadan, however, when Beschir asks *where* God was before he created the world? and wherefore did he create it? Schadan thus answers these questions: "*Where* indicates a place; and God not being contained in any space, to ask *where God was*, is an absurd question. The manner of acting peculiar to God is too elevated to afford room for asking *how* and *wherefore* he acts;

acts; by the sole omnipotence of his will he has produced those things which his knowledge embraced, and he produced them without means and without cause."

Schadan answers several literary questions in a similar manner; we shall quote one only, which presents a pleasing anecdote. Beschir asks him the origin of this Arabian proverb: "The camel would be a good bargain, were it not for the cursed animal hanging at its neck;" and Schadan relates the following story:

An Arab who was plagued with a vicious camel, exclaimed in a moment of anger: "May my wife be always barren if I do not sell thee for a piece of silver!" His choler being over, he devised the following method of fulfilling his oath, which he repented. He suspended a cat to the neck of his camel, and cried round the market, "A camel and cat to sell together, but not separately; the camel for a piece of silver, and the cat for 400." The people hearing this, exclaimed in the words of the proverb: "The camel would be a good bargain, were it not for the cursed animal at its neck."

Haroun invites the two young philosophers to his palace, thinking himself fortunate in securing their friendship. "Servant of God," said Beschir to him, "thy society is as little fit for us as ours is for thee." "How so?" said Haroun. "Because," answered the Arab, "thou art the slave of our slaves." The khalif became angry, but Beschir soon appeased him by explaining the meaning of his answer. Haroun dissolves into tears, and, on withdrawing, asks Beschir to be pleased to dictate something to him upon which he might meditate usefully. Beschir gives him this passage in the Alcoran:

"Have you not seen that we have granted them several years of respite? and when the vengeance with which we menaced them has come upon them, the respite we have granted them has been of no use to them."

The anonymous author has not given the sense of this passage correctly; but as he gives the original in a note, the translation may be easily rectified by those acquainted with the language.

The

The work of Hadji Khalfa consists of a short preface, an introduction, a bibliographical dictionary, and the conclusion.

The preface displays in few words the object the author has in view. The introduction is divided into five chapters, subdivided into sections, paragraphs, &c. The first chapter has for its object the definition of science in general, its division into various principal branches, and the subdivisions of these last; the second treats of the origin and history of sciences and books; the third, of the different classes of writers and books; the fourth contains general considerations upon the sciences, upon those who have cultivated them, upon the circumstances which favour their cultivation, and the obstacles to their progress; upon the qualities which a learned man ought to possess, and other similar subjects: the fifth chapter is a kind of supplement to the former, and contains various miscellaneous observations not alluded to in the preceding chapters.

In spite of the multitude of divisions and subdivisions in this treatise, which may be regarded as a synoptical picture of the sciences, and every thing relating to them, we do not think Hadji Khalfa has adopted the most perspicuous arrangement. He has often confounded considerations of a general nature with those which have a particular object; and although he may have had some idea of a general system of human knowledge, he is far from having realised this idea in a manner to entitle him to rank with Bacon, or the author of the preliminary discourse to the French Encyclopedia.

The work, however, notwithstanding its faults, deserves to be better known. The introduction is the most deserving of notice; and our anonymous author has translated it from beginning to end, with some slight exceptions, and it occupies nearly 160 pages of the volume. Some people, perhaps, would have preferred the suppression of this introduction, and would have wished to have seen, if not the whole, at least the principal articles of the Bibliographical Dictionary of Hadji Khalfa, from which those who cultivate Oriental literature would certainly derive very great advantages.

Mithridates: oder Allgemeine Sprachenkunde, mit dem "Vater-Unser," als Sprach-probe, in beynahe fünf hundert Sprachen und Mund-arten, von JOHANN CHRISTOPHER ADELUNG.—"Mithridates: or General Principles of Languages, with the Lord's Prayer as an Example, in nearly 500 Languages or Dialects, by JOHN CHRISTOPHER ADELUNG, Aulic Counsellor and Chief Librarian to the Elector of Saxony, with this Motto:

"Alius alio plus invenire potest, nemo omnia."—AUSONIUS.

Part I. Berlin 1806. 686 pages, exclusive of the Synoptical Table, the Preface, the Introduction, and the Alphabetical Table.

The learned and philosophical author of Mithridates is now no more, having finished a long laborious life, at the age of 75, about a year ago. He was one of the most indefatigable scholars in Germany, a country already so fertile in this class of men; he excelled in grammatical learning, and was distinguished in several other branches of science. Besides the excellent dictionary of his native language, which is as much celebrated in Germany as that of Dr. Johnson; besides his learned and judicious works upon German philology, Adelung has published numerous and valuable writings, both upon civil and literary history, as upon rational philosophy, physics, chemistry, and finally upon diplomacy. See the "Teutchland Gelehrte" of Hamberger and Meusel, article *Adelung*.

Mithridates, a posthumous work, and the fruit of fifteen years of assiduous labour, will furnish general notions upon all the languages, and the texts of each are carefully explained. The author has only been able to finish what concerns the languages of Asia and those of Europe. This first part comprehends the languages of Asia to the number of 159.

The second part is preparing for the press, and will embrace all the languages of Europe. It is only by taking it for granted that the work will be continued and completed, that we may flatter ourselves with possessing in this book every thing which the title promises, namely, general ideas

upon

upon all the known idioms, and the *Pater Noster* in five hundred languages or dialects.

We shall then be in possession, within a very narrow compass, of the materials necessary for resolving the splendid problem in the author's contemplation: we shall know the characters and differences of each language, in order to account for the progress, followed by reason and genius, among the different races of mankind, for determining with more certainty, or conjecturing with more probability, the origin of the idioms, and in part the history of the nations who speak them.

It would seem, however, that besides vocabularies, or attempts at vocabularies, in each language or dialect, three kinds of auxiliaries would be still desirable, in order to create or render complete the comparative science of the idioms of the whole earth.

The first would consist in faithful pictures of all the intonations and articulations of the known languages.

The second, in the different alphabets of these same languages, exactly drawn, with explanations which should announce and determine the value of each character.

The third, in order to serve as a kind of control, would be the knowledge of all the intonations and articulations of which the human voice is susceptible. It is thus that, in the different artificial arrangements employed in botany, we prefer uniting the advantages of the natural order.

But these auxiliaries are still wanting.

The first and second, with respect to the dead languages; because, in general these languages have several characters and vowels and consonants, upon the value of which the learned are not yet agreed; and with respect to certain languages in the Eastern part of Asia, because the characters of these languages are the signs of ideas, and by no means of sounds or articulations; and because, when pronounced, they give, in each of these idioms, words completely dissimilar with respect to perfectly identical ideas and written signs: lastly, with respect even to the living languages, and the characters of which represent intonations and articulations, because, as repeatedly confessed by the editors

editors and interpreters of foreign alphabets, without excepting the learned sir William Jones, it is impossible to represent in words the just value of certain characters, and the exact intonation or articulation they express.

We may add upon the subject of the unexplained simple representing of the existing alphabets, that this task alone, which is physically possible to execute, is, however, so tedious, laborious, and difficult, that in reality we have nothing of this kind but monographies. The work is executed with care and success with respect to some idioms: as to the generality of the known languages, there exists scarcely a single work where an attempt has been made to collect the methods of writing it, and it is a very defective attempt, the copies of which, however, are excessively scarce. This is called "Pantographia, containing accurate copies of all the known alphabets in the world; together with an English explanation of the peculiar force or power of each letter; to which are added specimens of all well authenticated oral languages, forming a comprehensive digest of phonology; by Edmund Fry, London, 1799," in one volume, 8vo. A German, too much led away by his imagination, also published in 1781 a kind of pantography, but executed in a still more execrable manner: it is a curious book, however, and is entitled "*Synopsis universæ* philologiæ, in quâ miranda unitas et harmonia linguarum totius orbis occulta eruitur, adornata a Gothofredo Henselio." Norimbergæ, in 8vo, one volume.

The above are the first two indications which we could wish to see satisfied.

The third object, which would be as much the province of physiology as of grammar, is equally difficult with the two others, in a double respect. On the one hand, it seems agreed that we cannot make known by words, *i. e.* by a clear and sufficient description, oral or written, some movements of the human voice, or certain very well known and often used effects of this organ, so mysterious in some measure, and so complicated in every respect. On the other hand, to consider even the convex and concave, the straight and spiral portions of this instrument only as so many straight lines:

lines: who is there so audacious, or so foolish, as to pretend to trace the scale of all their possible divisions, to classify and calculate all the effects of the general or partial concourse and reciprocal influences of all these parts? What alphabet can there be invented, to represent by simple signs so many new and delicate ideas? What an inexhaustible source of contradictions and endless disputes! Even at the present day our knowledge is not extended to the language of antient ideas.

Let us ask for example, between two analogous articulations D and T, which is the hard or the soft, the strong or the weak, we shall be told without doubt that T is the hardest; and the President de Brosses, Beauzee, &c., will be quoted: nevertheless, upon opening the excellent Port Royal Greek Grammar and its numerous abridgments, you find that the T is soft; and this grammar adds, that the consonant which is not soft, becomes so when we pronounce it *too gently*. Le Roy, in his Greek Grammar, is also clearly of opinion that T is soft; and in order to finish the climax, a learned Greek Grammar lately printed informs us that soft is synonymous with hard. Upon this point, therefore, and upon many others, the ideas and the language are still to be made and fixed.

This is a superfluous but a new proof of this truth, so frequently forgotten and incessantly confirmed by experience, that the human mind is on all occasions forced to acknowledge either its imbecility or its uncertainty. We find, on the subject of the alphabet, that it is often reduced, particularly when it wishes to embrace various languages, to content itself with approximations, probabilities, and hypotheses; happy if it can always avoid contradiction and error.

We shall see therefore without astonishment, that the learned author of Mithridates has not taken the pains to employ exotic characters, nor even to appropriate to his use, by necessary additions, the Roman alphabet, the only one he employs. He was of opinion that this alphabet pronounced broad as the Germans do, is sufficient to render in a tolerable manner the value of all the foreign alphabets.

We

We shall find, perhaps, that this is to content ourselves with a too distant approximation: the Roman alphabet, if we renounce exotic letters, certainly agrees better with facilitating some comparison of the languages with each other—the Russian language for example—because the first prevails among the most enlightened people in the world; but it will only procure incomplete or inaccurate notions of the numerous and important foreign languages, and most of which have peculiar sounds and articulations, such as the Roman alphabet cannot be used to express. It is necessary, in order to represent faithfully these languages with the letters of the Roman alphabet, to add to this alphabet some new characters, as the inhabitants of India, when writing the Shanscrit, when they neglect to employ the *Devanagari* characters, add certain letters to the alphabets of their *Chasha* or vulgar languages, because the Shanscrit is generally richer in sounds and intonations than the *Chasha*.

M. Volney has suggested that the Roman alphabet might be employed for writing the languages of Asia: see his *Methode nouvelle et facile d'apprendre les langues Arabe, Persane et Turque*. Paris, 1795, in 8vo. This idea may succeed with the assistance of the learned; it would save Europeans much time and trouble. An entirely new language has been agreed upon for chemistry: is it more difficult to grant, for certain languages, an alphabet already completely known in a great measure, and which, in time, might become the universal alphabet of the country?

Whatever may be the imperfection which results in the new Mithridates, from the exclusive employment of the Roman alphabet, deprived of the additions necessary for the comparison of languages, we admit that this book is singularly rich in facts relative to this comparison, and that it will be very useful even to those who possess the most novel works of this nature. It will be particularly so to experienced travellers, who may wish to procure a good guide in their inquiries upon the idioms of the countries they visit.

[To be continued.]

Dr. Beer, a celebrated oculist of Vienna, has addressed

a small pamphlet to the medical gentlemen of Great Britain, containing twenty-nine ingenious queries on the subject of the epidemical ophthalmia, which has recently appeared in the British army. This new contagion is as yet a stranger in the continental armies, and the medical practitioners in Germany and France seem to be unacquainted with its characters.

We are happy to find that Mr. Leybourn, of the Royal Military College, continues the publication of his valuable Repertory of Mathematical Science. The seventh number has made its appearance; and it is but justice to add, that the work has no way failed in the estimation formed of its character.

Mr. John Clennell, of Newcastle-upon-Tyne, has published an Essay on the propriety of disclosing the secrets of manufactories.

LV. *Proceedings of Learned Societies.*

ROYAL SOCIETY.

THIS Society met on the evenings of the 14th and 22d, when A. Marsden, esq., in consequence of the indisposition of the president, was in the chair. A very curious paper on Oxalic Acid, by Dr. T. Thomson of Edinburgh, was read. It contained the results of a great variety of experiments made to ascertain the relative qualities of the constituent parts of this acid, on a principle of calculation laid down by this able chemist in the last edition of his excellent System of Chemistry. It is impossible to convey any adequate idea of the various facts detailed in this interesting paper, in the present summary of the society's proceedings, as Mr. Davy's illness has unfortunately prevented him from attending the society, and the inexperience of the other secretaries in reading, and their low voices, were such as to render them scarcely audible.

SOCIETY

SOCIETY OF ANTIQUARIES.

N. Carlisle, esq., the secretary, laid before the society some ingenious observations on the round painted boards, containing verses and figures, found in some families in Staffordshire, and called *rondles*. A great many conjectures on the origin and use of these round boards, about five inches in diameter, and one fourth of an inch thick, were extracted from the Gentleman's Magazine; and it is supposed that they are of the age of Henry VII. or VIII.; that they had been imported from Flanders, and used either as conversation cards, or wooden platters. The circumstance of their being found chiefly in Staffordshire sanctioned this opinion, and that they might have been the precursors of some of our Delft ware. The poetical stanzas, written in old English characters, supposed of the above age, are chiefly amatory, and some of them rather indelicate: the poetry is generally as bad as the sentiments are trifling. The figures are also very coarse, and painted mostly round the outside, and the verses in the centre.

ROYAL INSTITUTION.

The following arrangement has been made for the Lectures of the ensuing season, which commenced on the 13th instant (January):

Mr. Davy, a Course on Geology.

———————— on the Elements of Electrochemical Science.

Mr. Allen, on Mechanical Inventions.

———————— Natural Philosophy.

Mr. Coleridge, on the distinguished English Poets, in Illustration of the General Principles of Poetry.

Rev. Mr. Crowe, on Architecture, an extended Course.

Rev. Mr. Hewlett, on Belles Lettres, 4th Course.

Rev. T. F. Dibdin, English Literature, 3d Course.

Dr. Callcott, on German Music.

———————— on the Music of the 18th Century.

Dr. Smith, on Botany.

Mr. Craig, on the Principles and Practice of Drawing, Painting, and Engraving.

Mr. Wood, on Perspective.

ROYAL SOCIETY OF GÖTTINGEN.

The Royal Society of Arts and Sciences of Göttingen has offered a prize of 50 golden ducats, for the best Memoir on the following subject: "The difference of colour remarked between the blood of the veins and that of the arteries having induced an opinion among several of the learned, that the same difference exists in the blood of the embryo in an inverse degree; but as experience has never confirmed this with respect to new-born infants, the society is desirous that, by researches and direct experiments upon infants born of healthy mothers, (either by the instant ligature of the umbilical cord at its two extremities, at the moment of their birth, or in any other way,) it should be determined if there really exists an inverse difference in the colour of the blood; in what it consists; what are the constituent principles of the blood of the infant;—keeping out of the question the acid particles, which must be mixed with it by the contact of the atmosphere?"

The memoirs in answer to this question must be transmitted to the society previous to September 1808.

UNIVERSITY OF GÖTTINGEN.

The following question has been announced for the subject of a prize essay, by the University of Göttingen: "What is the influence of the acid and other kinds of gases upon electricity produced by friction? and what are the relations of the other electrical phænomena, such as attractions, repulsions, sparks, &c., with the principal gases?" This question has been announced for two successive years; but the memoirs not being satisfactory, it has been renewed for the year 1809.

LVI. *Intelligence and Miscellaneous Articles.*

PROFESSOR DAVY'S NEW METALS.

THE experiments of Mr Davy on the alkalies were repeated on the 14th and 28th instant (January) before the Askesian and Mineralogical Society, with a very large Galvanic apparatus of Mr. Pepys's, consisting of 120 pairs of plates of 36 inches surface each (containing near seven

hundred weight of copper and zinc). The solid caustic potash was used, slightly moistened by the breath. The metaloid obtained was highly inflammable, swam in rectified naphtha, but was difficultly separated from the potash, in which it is plentifully imbedded, after being exposed to the Galvanic action. Water being dropped upon it, the particles explode similarly to grains of gunpowder thrown into the fire.

The metaloid obtained from soda is not so highly inflammable, and can therefore be collected more easily. A globule about the size of a small tare being thrown on paper moistened, instantly became apparently red-hot, and, running off the surface of the paper, fell luminously through the air.

Mr. Allen has also repeated Mr. Davy's experiments, and obtained both the metaloids by four troughs of fifty pairs each of sixteen inches surface. The metaloids obtained by Mr. Allen were exhibited by Dr. Marcet at the Theatre of Guy's Hospital.

Mr. Dibdin, in his introductory lecture at the Royal Institution, a few days ago, announced that some of the primitive earths, as they are called, such as Barytes and Strontian, having many alkaline qualities, Mr. Davy was induced to submit them to similar experiments, and has discovered that these also consist of metallic bases, united to oxygen, forming compound bodies analogous to the two fixed alkalies.

To Mr. Tilloch.

SIR, London, Jan. 24, 1808.

I AM convinced you would not wish any mistakes to remain uncorrected in your excellent Magazine.

I have just read the account given in the Number for November, of Mr. Davy's Bakerian Lecture. Your Report, I am sorry to say, is in some particulars not quite correct. I was present at the reading of the paper before the Royal Society, and I paid particular attention to the statements of facts.

It will be merely doing justice to the author, to mention accurately the particulars of his important discovery.

It is stated in your Magazine, that the basis of potash is volatile at 100°. Mr. Davy's account was, that "it is volatile at a heat a little below redness."—It is likewise said that the amalgam of the bases of potash and quicksilver, when applied in the circle of a Galvanic battery, dissolved iron, silver, gold, and platina. Mr. Davy merely mentioned that it dissolved these metals; he said nothing that I can recollect of the Galvanic battery.

Glass, it is said by the Reporter on the Lecture, as well as all *other* metallic bodies, was dissolved by the basis of potash.

The real statement with regard to glass was, that the basis of potash decomposed it by combining with its alkali, and by forming a red oxide of less degree of oxygenation than potash; which oxide was likewise procured by other means.

It is stated that the specific gravity of the basis of soda is to that of water as 7 to 10. Mr. Davy said "as 9 to 10."

Mr. Davy mentioned nothing about the effects of these new and extraordinary bodies upon the phosphates and phosphurets; but detailed some remarkable experiments on the phænomena of their combinations with phosphorus and sulphur. He said nothing concerning the specific gravity of the amalgams of the bases of potash and soda.

As the account in the Philosophical Magazine has been copied into many periodical publications, it is but justice to the discoverer of these new facts to correct its inaccuracies; as otherwise they may be attributed to the author by those who repeat his experiments, on the faith of the statements.

You will, therefore, I trust, take the trouble of inserting this letter in your next number. I am, sir, with great respect,

your obliged humble servant,

A Chemist.

NAPOLEON'S PRIZE FOR GALVANISM.

The annual prize of 3000 livres, founded by the emperor of the French for the best experiment made in the course of the year on the Galvanic fluid, has been decreed to Mr. Davy, member of the Royal Society of London, for his Memoir on the Chemical Action of Electricity.

NEW PHOTOMETRICAL TELESCOPE.

Dr. Brewster of Edinburgh has invented a photometrical telescope, the primary object of which is to ascertain the relative brightness of the fixed stars, though it is capable of measuring the relative intensities of all other lights. Without any additional apparatus, it becomes a micrometer for measuring the distance of any two stars comprehended in the field of view, or the angle subtended by any two luminous points.

SINGULAR CURE FOR THE GOUT.

M. Cadet de Vaux, in his Journal d'Economie Rurale, mentions the following as a fact:

"A lady above eighty years of age, whom I have the honour of knowing intimately, was attacked with rheumatic gout thirty years ago. It seized the whole body; her pains were excessive; and during six weeks the efforts of art to relieve her were ineffectual; when a friend of the lady mentioned the cure of a similar disorder by drinking enormous quantities of hot water, to the amount of forty-eight glasses in the space of twelve hours. The severity of the pains the lady endured determined her to make the experiment, and she set about taking, every quarter of an hour, a cup containing seven or eight ounces of *hot* water (not merely *warm*, as this occasions vomiting, an effect that is not required). Thirty glasses were found sufficient to remove the pains, as it were by enchantment. She then stopped, and fell into a profound sleep, which she had not enjoyed for a long time before. Nothing of the disorder remained, except a sense of weight in one arm; but dreading a relapse, she determined, after a fortnight, to repeat the operation, and carried it on this occasion to forty glasses; when hunger, and a desire to sleep, put a stop to the experiment. From this time the cure was complete.

"About fifteen years afterwards, the same lady, then sixty-five years old, had a new attack of her former disease, with an entire loss of the use of her limbs: she had recourse to her former remedy of hot water, and with the same success as before. From that time she has had no return of the disease, and at present enjoys a good state of health."

M. Griebel,

M. Griebel, a watch-maker of Paris, has invented a clock without weights, of a globular form, the dial-plate of which is transparent, and, by means of a reflecting lamp on Argand's construction, shows the figure to a great distance. By a particularity of formation, neither the wheels, the hands, nor the pendulum, cast any shadow. The light may be made stronger or weaker, and adapted to the sick-chamber, or to clocks in the most public situations; where it answers the purpose of a time-piece and a lamp at the same time.

LECTURES.

On Monday, February the 2d, Dr. G. Pearson's Course of Lectures on the Materia Medica, Practice of Physic, and Chemistry, will re-commence at No. 9, George-street, Hanover-square, at the usual morning hours, viz: the Materia Medica at a quarter before eight, the Practice of Physic at half after eight, and the Chemistry at a quarter after nine.

St. Thomas's and Guy's Hospitals.

The Spring Courses of Lectures at these adjoining Hospitals will commence the beginning of February, viz.:

At St. Thomas's.

Anatomy, and the Operations of Surgery, by Mr. Cline and Mr. Cooper.

Principles and Practice of Surgery, by Mr. Cooper.

At Guy's.

Practice of Medicine, by Dr. Babington and Dr. Curry.

Chemistry, by Dr. Babington, Dr. Marcet, and Mr. Allen.

Experimental Philosophy, by Mr. Allen.

Theory of Medicine, and Materia Medica, by Dr. Curry and Dr. Cholmeley.

Midwifery, and Diseases of Women and Children, by Dr. Haighton.

Physiology, or Laws of the Animal Œconomy, by Dr. Haighton.

Structure and Diseases of the Teeth, by Mr. Fox.

N. B. These several Lectures are so arranged, that no two of them interfere in the hours of attendance; and the whole, together with the Lectures on Anatomy, and those on the Principles and Practice of Surgery, given at the Theatre of St. Thomas's Hospital adjoining, is calculated to form a Complete Course of Medical and Chirurgical Instructions.—Terms and other particulars may be learnt from Mr. Stocker, apothecary to Guy's Hospital.

METEORO-

Fig. 1.

Fig. 3.

Fig. 2.

1
2

Plan for circular Buildings.

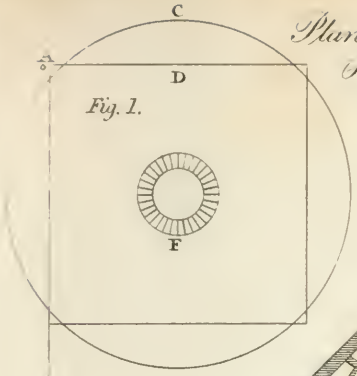


Fig. 1.

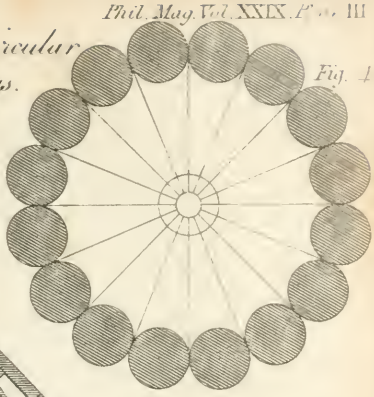


Fig. 4.

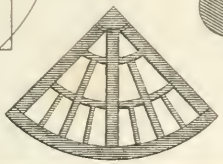
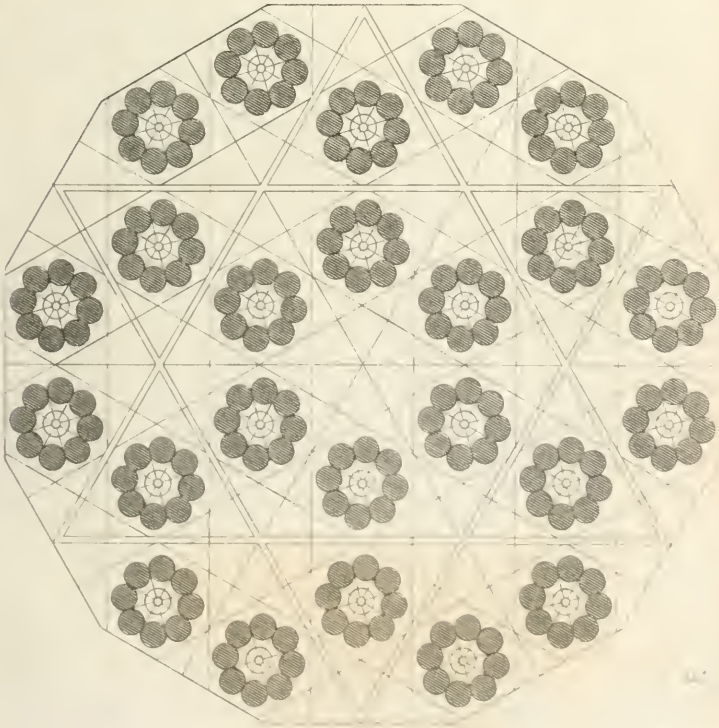


Fig. 3.

Fig. 2.

Fig. 5.



Pepys's Eudiometer.

Fig. 1.

Fig. 3.

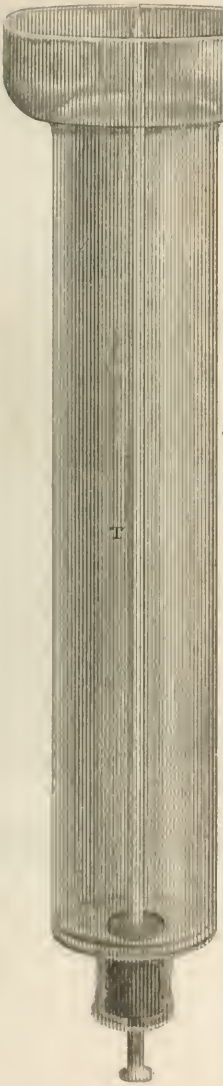


Fig. 2.

Fig. 4.

Fig. 5.

Alter Apparat

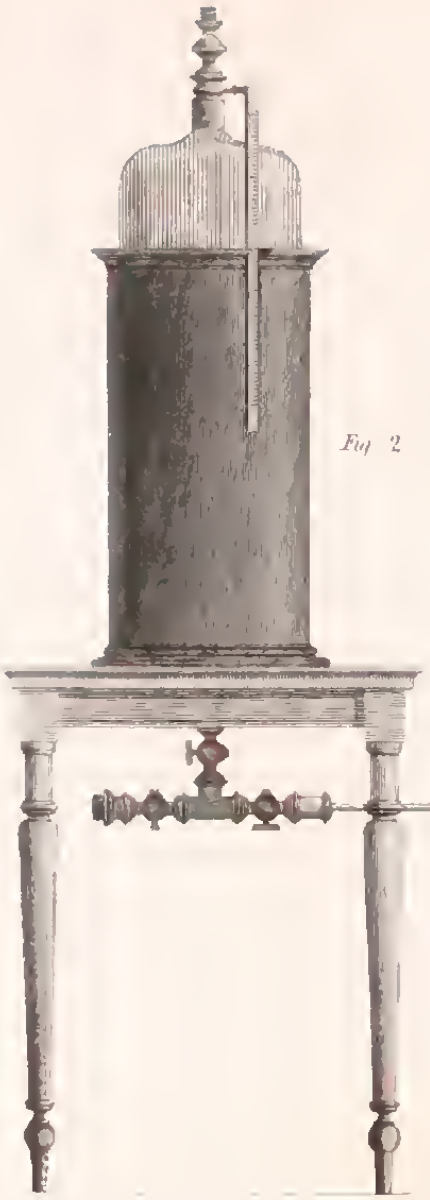
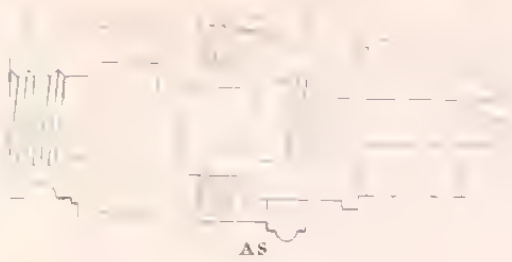


Fig. 2



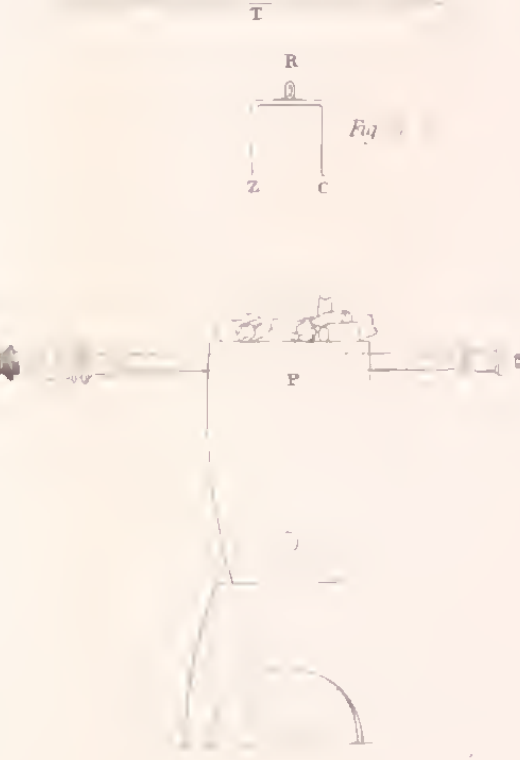


Fig. 3

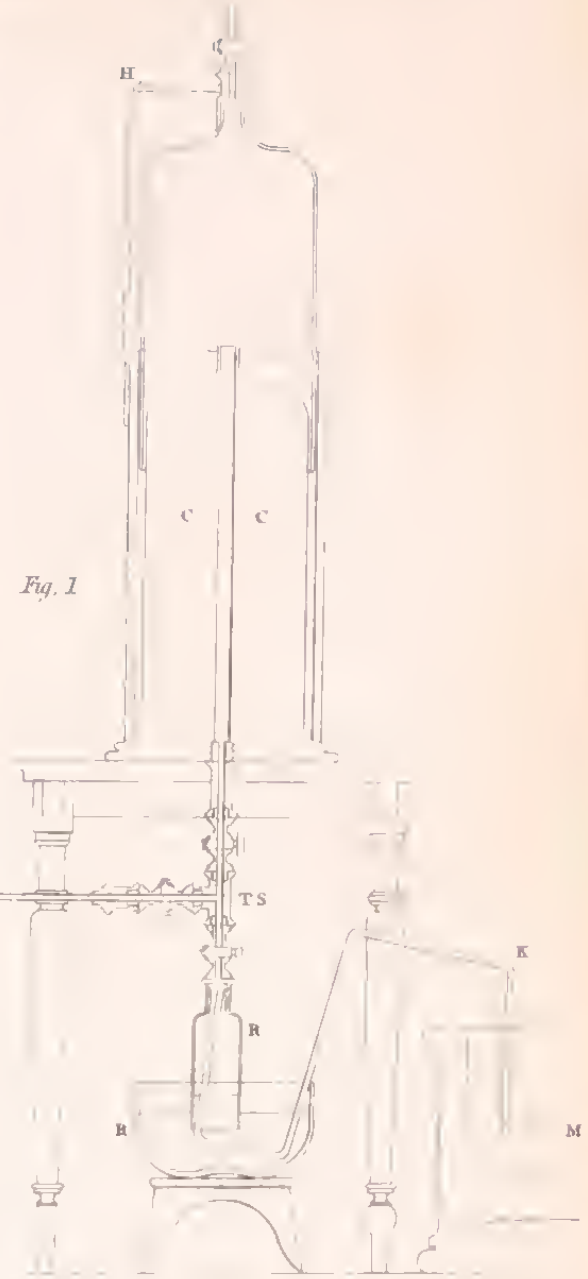


Fig. 1

ELEPHANTS. PL. IV.

Fig. 1. I.

Fig. 3. F.

Fig. 5. I.

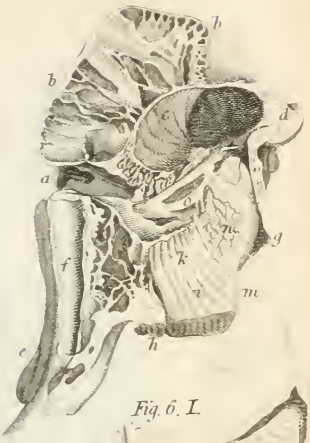


Fig. 2. A.

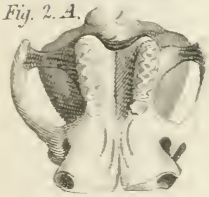


Fig. 4. F.

Fig. 6. I.

Fig. 7. F.

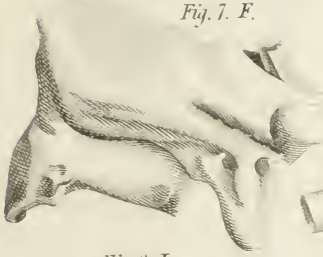
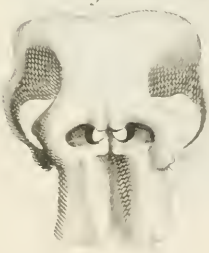


Fig. 8. F.

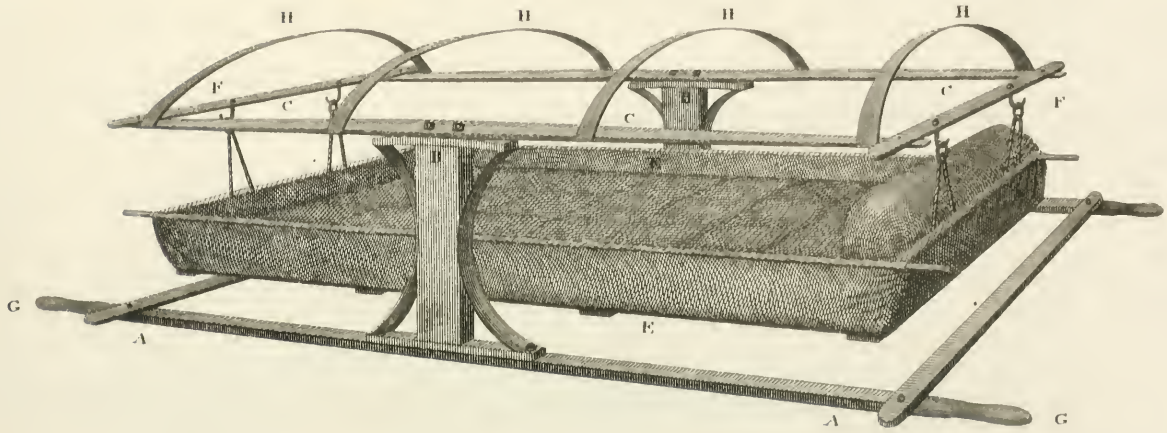
Fig. 11. F.

Fig. 9. I.

Fig. 10. A.



Plan of Col. Crichton's Bed for the easy Conveyance of Sick or Wounded Soldiers.



S. Porter sculp.

Fig. II.

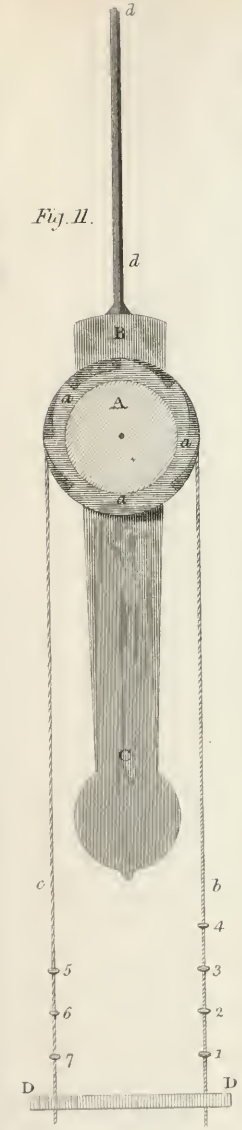
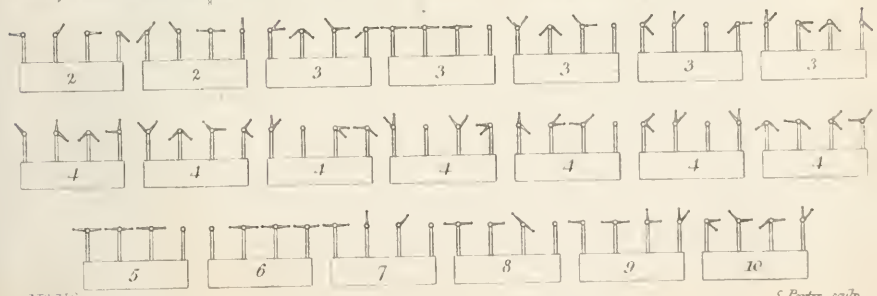


TABLE of COMBINATIONS, or KEY of the TELEGRAPH.

Signal N°	Combination shewn.	SIGNIFICATION	Signal N°	Combination shewn.	SIGNIFICATION
1.		1	15		E
2		2	16		F
3		3	17		G
4		4	18		H
5		5	19		I. J. Y
6		6	20		L
7		7	21		M
8		8	22		N
9		9	23		O
10		10 initial, O	24		P
11		A	25		R
12		B	26		S, C soft, Z
13		C hard, K, Q	27		T
14		D	28		U, V, W



S. Porter sculp.

METEOROLOGICAL TABLE,

By Mr. Carey, of the Strand,

For January 1808.

Days of the Month.	Thermometer. 8 o'Clock, Morning.	Thermometer. Noon.	Thermometer. 11 o'Clock, Night.	Height of the Barom. Inches.	Decrease of Dryness by Leslie's Hygrometer.	Weather.
Dec. 27	46°	46°	38°	29·72	6	Cloudy
28	40	46	47	·78	15	Cloudy
29	48	51	44	·37	10	High wind and cloudy
30	47	46	36	·62	8	Fair
31	41	47	46	·45	0	Stormy
Jan. 1	46	45	42	·21	12	Fair
2	45	42	40	·02	20	Fair
3	33	40	34	·31	15	Fair
4	33	37	44	·92	22	Fair
5	46	49	42	·67	0	Rain
6	40	49	46	30·31	21	Fair
7	46	48	49	·45	7	Cloudy
8	46	45	43	·51	0	Cloudy
9	41	45	42	·50	0	Cloudy
10	46	46	46	·30	5	Cloudy
11	46	47	40	29·92	12	Fair
12	36	39	36	·80	16	Fair
13	36	45	42	·72	18	Fair
14	46	39	34	·25	0	Stormy
15	30	35	29	30·02	21	Fair
16	26	30	28	·10	12	Foggy
17	26	34	27	·38	15	Fair
18	26	33	30	·41	10	Fair
19	35	39	37	·02	0	Cloudy
20	37	40	30	29·60	18	Fair
21	22	28	22	·82	7	Small snow
22	16	27	23	30·14	15	Fair
23	29	37	38	29·91	0	Rain
24	35	39	36	·75	5	Cloudy
25	36	39	30	·32	0	Small rain
26	28	35	30	·30	10	Fair

N. B. The Barometer's height is taken at one o'clock.

INDEX TO VOL. XXIX.

ACID Muriatic, Carbonic, Sulphuric, reagents for, 17; *Muriatic*, supposed formation of by Galvanism, 19; *Gallic*, history of, 29; *Carbonic*, quantity of carbon in, 216, 315
Adams's discovery of a Mammoth, 141
Adelung's Mithridates. Account of, 365
Alkalies. Composition of, 180, 372
Allen on carbonic acid, 216, 315
Alum to purify, 281
Ammonia. Reagents for, 17
Animal charcoal. Exper. on, 320
Antiquaries. Society of, 183, 276, 371
Antiquities. Christian 228, Jewish 237
Architecture, 97
Astronomy, 91, 115, 183, 285

Barytes, a compound, 373
Bed for conveying sick or wounded persons, 289
Bees. On the œconomy of, 194
Biography, 38, 129, 255, 262, 325
Blood. Iron found in, 275
Boilers—Tube. On, 283
Books. Notices respecting, 171, 189, 270, 354
Botany, 85, 95
Box-wood-charcoal. Ex. on, 223
Brewster's micrometer, 48
——— new photometrical telescope 375
British Institution, 277
Buchanan's Essay on warming buildings, 272
Building. Proposal for a new system of, 97

Canada. Statistical account of, 1
Canals. On locks for, 94
Carbon, quantity of, in carbonic acid, 216, 315
Carbonate of Lime. Acid in one hundred parts, 317
Carey's meteorological tables, 96, 192, 288, 377
Carlisle. On muscles, 275
Charcoal Animal. Exper. on, 320
Charcoal, Box-wood. Exper. on, 223
Chaulnes, (Duke de) life of, 262
Christians in India, 69, 228
Clennell on public libraries, 126
Clock, singular, 376
Coal. Experiments on combustion of, 317
Cochin. State of Christians in, 69
Colours. Prieur on, 11
Comet. A new one, 90, 188, 285
Crichton's bed for conveying wounded soldiers, 289
Crystallography, 276
Cuvier on elephants, 52, 244

Darwin, (Dr.) life of, 38, 129, 255, 325
Davy's discovery of the bases of potash and soda, 180, 372
Descostils on a fulminating silver, 36
Diamond. Allen and Pepys on, 216, 315
Duncan's proposal for a national museum, 193, 296

Elephants. On living and fossil, 52, 244
Ether Nitric. On, 281
Eudiometer. Pepys's new, 116
Eye. On the power of, 342

Farey on musical temper. 345
Field's new system of building, 97
Fluxions. On, 211
Foundry. On antient, 20, 154
Fourcroy's chemical philos. 171
French National Institute, 85, 164, 277
Fulminating Silver. On, 36

Gall nuts. Experiments on, 29
Galt's statistical account of Upper Canada, 1
Galvanism. On, 19, 243, 374
Geography, 95
Gout. Remedy for, 375
Graham on starch-making, 166
Gregory's (O.) translation of Haüy's Nat. Phil. 271

Haüy's natural philosophy, 271
Heat, effects of, in producing colours, 11. On gall nuts, 29
Hemp. Culture of, 7
Hindostan. Christians in, 228
Home on the functions of the spleen, 183, 273
Hume on destroying insects, 353

India. State of Christians in, 69
Insects. On destroying, 353
Instinct. On, 88, 184
Iron found in blood, peas, eggs, bile, urine, 275
Iron Ores. Chrome, phosphorus and manganese found in, 279

Knight on the œconomy of bees, 104

Lagrange on gallic acid, 29
Lakes. Remarks on, 5
Learned Societies, 85, 180, 270, 273, 370
Lectures, 286, 376
Libraries. On public, 126

Mammoth. Discovery of one, 141
Manuscripts. Curious, 228
Mechanics. New power in, 351
Medicine, 375
Metals, two new ones, 180, 372
Meteoric Stones. Conjectures on, 279
Meteorology, 96, 192, 288, 377
Micrometer. Brewster's, 48
Mineralogy, 279
Moon, Horizontal. On, 65
Muscles. Carlisle on, 275
Museum, National. Proposed, 193, 296
Musical Scale. On temperaments of, 345

Napoleon's Galvanic prize awarded to Professor Davy, 374
National Museum. Proposal for, 193, 296
Nitric Ether. On, 281

Optical experiments, 340

Painting. Oil used in before 1410, 276
Pasley's construction of telegraphs 205, 292
Patents, 191, 285
Pepys's new eudiometer, 116—on carbonic acid, 216, 315
Pfaff on reagents for acids and ammonia, 17; on supposed formation of muriatic acid, 19
Platina found in Europe, 278
Plumbago. Exper. with, 319
Potash proved to be an oxide of a metal 180, 372
Prieur on light and colours, 11
Prize questions, 372
Publications, new, 171, 189, 270, 354

Reagents for muriatic, carbonic, and sulphuric acids, and ammonia, 17
Royal Institution, 371
Royal Society, 180, 270, 273, 370
Royal Society of Göttingen, 372

Schroeter on the planet Vesta, 115
Seitz on antient foundry, 20, 154
Silver. On fulminating, 36

Smithson on quadruple and binary compounds, 275
Soap made by the heat of steam, 283
Society of Antiquaries, 183, 276 371
Societies Learned, 85, 180, 270, 273, 370
Soda discovered to be an oxide of a peculiar metal 180, 372
Spleen. Home on the, 183, 273
Stanhope temperament. On, 347
Starch. On making, 166
Statistics. Account of Upper Canada. 1
Statues. On founding, 20, 159
Steam employed to heat buildings, 272; to boil soap-pans, 283
Strontian, a compound, 373
Sulphur. What? 240
Sulphurets, references to, 275
Surgical cases, 83, 169, 267, 349, 375
Symbols for the deafly-dumb, 273
Syrian churches in India, 229
Taunton's Reports of the Finsbury Dispensary, 83, 169, 267, 349
Taylor's Theorem for the development of the function $\varphi(z + x)$ observations on, 211
Telegraphs of a new construction 205, 292
Telescope, photometrical, 375
Travancore. State of Christians in, 69
Travels, 141, 190

Vaccination, 189, 277
Vegetables. On analysis of juice of, 281
Vesta. On the planet, 115
Vision. Properties of, 340

Walker (E.) on the horizontal moon, 65; on the power of the eye, 340
Walker W. on the new comet, 91
Wasps. On the production of, 186
Wilkinson's improved galvanic trough, 243

*** *Our Readers are requested to supply some Omissions in Capt.* PASLEY'S *Communication.*

In the Key of the Nocturnal Telegraph, (page 210,) the following Numbers appropriated to the several Signals were omitted to be inserted:

For signal No. 21st, the appropriate numbers are 2, 4, 5. For signal 22d, 1, 2, 3, 4. For signal 23d, 1, 2, 3, 5. For signal 24th, 1, 2, 4, 5. For signal 25th, 1, 3, 4, 5. For signal 26th, 2, 3, 4, 5. For signal 27th, 0, 1, 2, 4. For signal 28th, 0, 1, 2. For signal 29th, 0, 1, 3, 4. For signal 30th, 1, 2, 3, 4, 5. For signal 31st, 0, 1, 3, 5. For signal 32d, 0, 1, 4, 5. For signal 33d, 0, 2, 3, 5. For signal 34th, 0, 2, 4, 5. For signal 35th, 0, 1, 2, 3, 4. For signal 36th, 0, 1, 2, 3, 5. For signal 37th, 0, 1, 2, 4, 5. For signal 38th, 0, 1, 3, 4, 5. For signal 39th, 0, 2, 3, 4, 5. For signal 40th, 0, 1, 2, 3, 4, 5.

In Mr. Duncan's Paper, p. 199, for "motion of any power" read "of any body:"—p. 196, for "Lord William" read "Lord Webb."

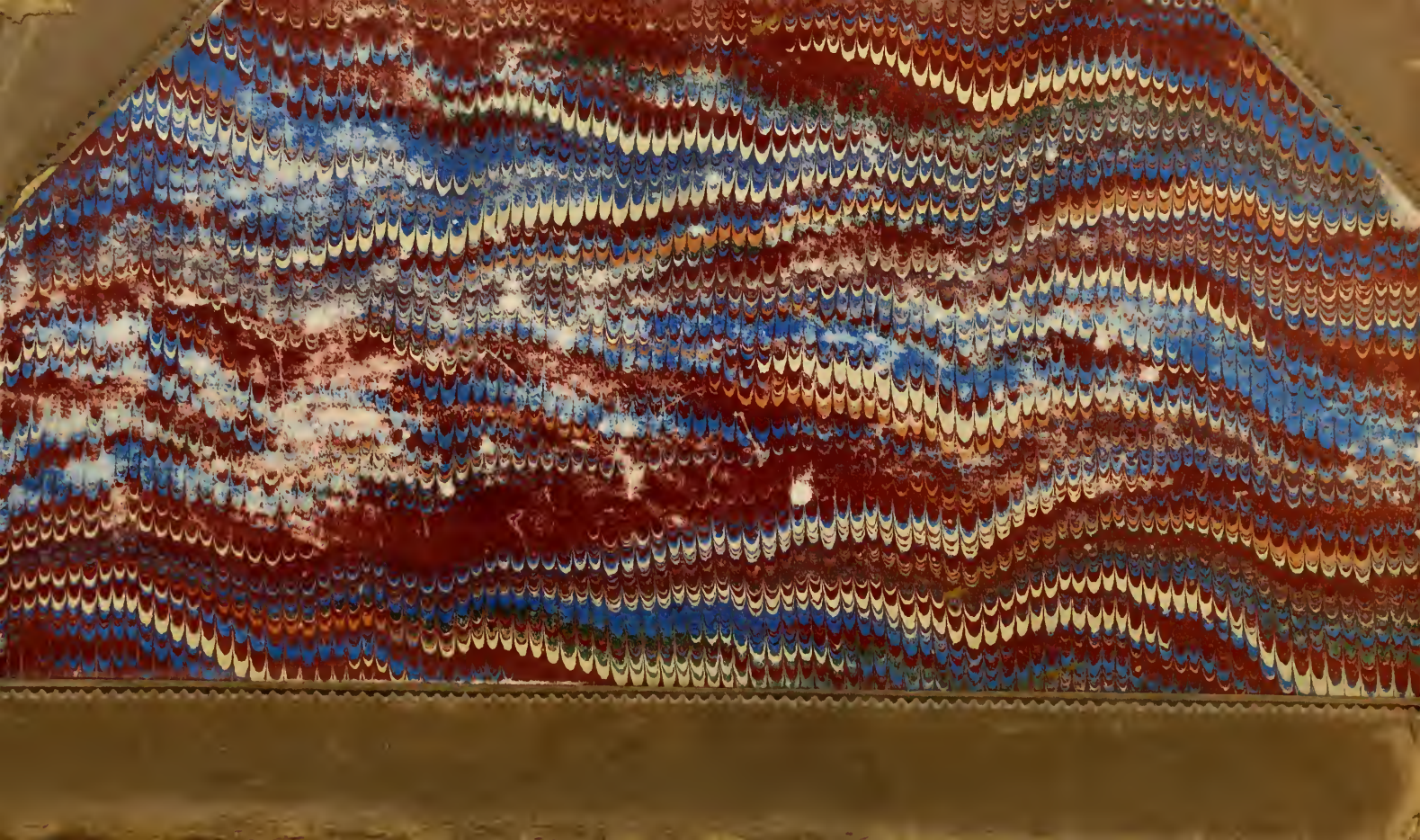
END OF THE TWENTY-NINTH VOLUME.

Printed by Richard Taylor and Co., Shoe Lane.

QC
1
P4
v.29

The Philosophical magazine

Physical &
Applied Sci.
Serials

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY